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TYPE CERTIFICATION

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RECORD OF CHANGES

DIRECTIVE NO. 8110.4

CHANGE TO BASIC	SUPPLEMENTS			OPTIONAL USE	CHANGE TO BASIC	SUPPLEMENTS			OPTIONAL USE
Chgs 1 thru 22				Consolidated reprint; October 1978					
Chg 23				Consolidated reprint; June 1985					

FOREWORD

1. PURPOSE. This handbook has been prepared to guide and assist all Engineering and Manufacturing personnel, Washington and Field, including International Field offices when applicable, in properly discharging their responsibilities and efficiently accomplishing their assigned tasks.

2. CANCELLATION. FS P 8110.1, Type Certification, is canceled in its entirety.

3. PUBLIC AVAILABILITY OF INFORMATION. This handbook is in no way restricted and the employee to whom it is issued will make it available for review by the public upon request. Copies of this handbook may be obtained (for a nominal fee) by written request to the Manager of Headquarters Operations, Federal Aviation Administration, 800 Independence Avenue, S.W., Washington, D.C. 20590.

Edward C Hodson

Director,
Flight Standards Service

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CHAPTER 1. GENERAL INFORMATION

1. PURPOSE AND SCOPE.

   a. This handbook has been prepared to guide and assist all Engineering and Manufacturing personnel, Washington and Field, including International Field offices when applicable, in properly discharging their responsibilities and efficiently accomplishing their assigned tasks. Due to varied regional organizational structures, titles used in this handbook, i.e., Chief, Engineering and Manufacturing Branch, will also connote other comparable organizational segments. It is planned that, ultimately, quantitative requirements will be deleted from this handbook and appear only in the program guidelines.

   b. An effort has been made to cover important phases of procedures encountered in engineering and inspection activities. Obviously, it is impractical to cover all situations or conditions that may arise and, hence, these instructions must be supplemented by good judgment in handling the particular problems involved. In each case, however, our thinking should be directed toward the systemsworthiness concept.

2. DEVIATIONS. Depending upon the nature of the particular problem, it may sometimes become necessary to deviate from the policies and procedures outlined herein. In these cases, the individual should be guided by the spirit underlying these instructions associated with sound judgment, making certain that all deviations are substantiated, documented, and concurred in by the individual's supervisor. Any substantial deviation from these instructions should, however, first be approved by the Engineering and Manufacturing Division, FS-100, Washington, D.C., in order to assure uniform administration.

3. RESPONSIBILITY FOR ISSUANCE AND REVISION. The issuance, change or cancellation of material in this handbook will be accomplished by the Engineering and Manufacturing Division, FS-100, as may be found in the best interest of the Division's programs. However, all personnel assigned to Engineering and Manufacturing Division programs are urged to submit recommendations through channels for revisions to the handbook which they believe would be advantageous. Each such recommendation should clearly identify the purpose and substance of the change.

4. ABBREVIATIONS. Abbreviations as used in this handbook are as follows:

   a. FARs, Federal Aviation Regulations
   b. CAR, Civil Air Regulations
   c. STOL, short take off and landing
   d. VTOL, vertical take off and landing
   e. V/STOL, vertical/short take off and landing

f. TC, type certificate
g. PMA, Parts Manufacturer Approval
h. TIR, type inspection report
i. TIA, type inspection authorization
j. ADI, antidetonant injection
k. C.G., center of gravity
l. MAC, mean aerodynamic chord
m. STC, supplemental type certificate
n. DER, Designated Engineering Representative
o. DOA, delegation option authorization
p. NASA, National Aeronautics and Space Administration
q. WADC, Wright Aeronautical Development Center
r. AEER, Airframe and Equipment Engineering Report
s. CO, carbon monoxide
t. CAM, Civil Aeronautics Manual
u. ILS, Instrument Landing System
v. DAS, Designated Alteration Station

*5. MEANING OF WORDS AND TERMS. Any word or term which is used in an airworthiness regulation but is not understood when the regulation is applied should be brought to the attention of the Engineering and Manufacturing Division at Washington. Correspondence on the matter should include a suggested meaning of the word or term. The division will initiate action to issue a definition or clarification in an appropriate form, e.g., proposed amendment to the regulations, glossary definition, advisory circular, or engineering report.

6. RESERVED. *

CHAPTER 2. CERTIFICATION PROCEDURES

SECTION 1. GENERAL

7. GENERAL. The responsibility given to the Federal Aviation Administration, under the Federal Aviation Act of 1958, for the type certification of aircraft, engines, propellers and appliances is accomplished by the Washington and regional offices of the Engineering and Manufacturing Division. The presently established functions of these offices are as stated in FS P 1100.1, Flight Standards Organization Handbook and 1100.3, FAA Organization Handbook, respectively.

*8. SPECIAL CONDITIONS.

a. Basis for Issuance. FAR 21 provides for the issue and amendment of special conditions and sets forth the circumstances under which special conditions may be applied in the type certification of a product. Under the provisions of Section 21.16 a special condition is issued only if the applicable airworthiness regulations do not contain adequate or appropriate safety standards for an aircraft, aircraft engine, or propeller because of a novel or unusual design feature of one of these products. A special condition contains only such safety standards as are necessary to establish a level of airworthiness equivalent to that established in the applicable regulations. An example of the possible need for special conditions would be the installation of turbine engines on a small airplane if there were no requirements directed to turbine installation in FAR 23. Special conditions are also exemplified in tentative standards for V/STOL aircraft, where neither the airplane nor the rotorcraft airworthiness regulations would be adequate or appropriate to cover the novel or unusual design features of this kind of aircraft. Another important example of a special condition, which can arise at any time, is one required to cover an unusual flight characteristic which, if not properly covered, would make an aircraft unsafe even though compliance had been established with all of the applicable airworthiness requirements. Special conditions, in accordance with Amendment 21-19, are private rules. The Administrator has delegated authority for their issuance to the Director, Flight Standards Service.

b. Procedures for Issuance.

(1) Regional Action. Proposed special conditions will be developed by regional offices in conjunction with applications for type certificates, for amendments thereto, and for supplemental type certificates. The proposals will be*

formulated with full participation by the applicant and with any other interested persons as deemed appropriate by the regional office. They will be forwarded to the Engineering and Manufacturing Division, FS-100, together with full particulars and justification for each special condition being proposed. Care should be taken, in cases where the design feature is covered by an objective rule, not to include as a special condition a particular method or technique used to show compliance with the rule. In those cases where a special condition is appropriate, but the applicant indicates that he already has or will voluntarily comply, the special condition nonetheless will be proposed. It is essential that the list of special conditions be complete. This is required to establish the basis of certification and to form an exact record for the future of the rules applicable to the product. When the application is for an amendment of a type certificate or for a supplemental type certificate, FAR 21.101(b) becomes applicable.

* If the finding cited in FAR 21.101(b) is made, a special condition should not be formulated until it has been determined that there is no applicable requirement in effect on the date of the application for the change which would provide a level of safety equal to that established by the regulations incorporated by reference in the type certificate for the product. If a requirement is found to be applicable and in effect, and would provide the requisite level of safety, it should be specified in the basis of certification and applied to the design change. After all such requirements have been applied, if a special condition is still determined to be necessary, it may be applied in accordance with the provisions of FAR 21.16(a). In applying a current requirement, under FAR 21.101(b)(1), the same kind and degree of justification should be established as that required for the issuance of a special condition.

(2) Sequence of Action. Although special conditions are issued by the Director, his action depends upon preliminary technical work done by the controlling region in each case and upon successful and timely coordination with the manufacturer or other applicant and other interested persons. The main steps in carrying out these actions are:

(a) Development of the proposed special conditions by the controlling region, after providing the applicant an opportunity to participate, and submittal of the proposal to FS-100;

(b) Review of the proposed special condition by FS-100 and forwarding of its recommended special conditions to the controlling region for coordination; *

(c) Coordination between the controlling region and the applicant;

(d) Evaluation of the coordination and preparation of final comments on the recommended special condition by the controlling region and submittal of comments to FS-100;

(e) Final evaluation of special condition by FS-100 in light of comments from the region, the manufacturer, and other interested persons; and

(f) Preparation of legal draft of special condition by the Office of the General Counsel.

(3) Urgency of Action. At the time of the preliminary type board meeting the controlling region will initiate the setting of a deadline date for establishing the initial special conditions (which may be modified and additional special conditions issued as technical information is developed during the type certification program.). The Region, taking due account of the time needed to complete each of the six main steps, and reflecting the relative urgency of having special conditions established for the particular program, will suggest a deadline date to FS-100. In certain cases the importance or urgency of the program will require faster handling than is ordinarily scheduled. When the controlling region believes it has such a case it will recommend that arrangements be made to expedite the procedure by a meeting between the region, FS-100, and the manufacturer. This meeting should settle the issues and result in final coordination of the recommended special conditions.

(4) Justification. In some instances, during the first year and a half following the promulgation of FAR 21.16, lack of sufficient information has delayed the processing of special conditions proposed by regional offices. A lack of proper and sufficient justification has also contributed to delay in processing. Full information from the region is needed covering the general characteristics of the aircraft or other product and covering its unusual design features. The following is the type of information frequently lacking:

(a) The full certification basis, indicated in a manner similar to that which would be shown on the type data sheet;

(b) A general description of the product, e.g., for an airplane, location of wings, number and type of engines, maximum weight, speeds, seating capacity, etc.;

(c) Description of features having a bearing on the need for special conditions, e.g., turbine engines, reversible propellers, unconventional controls or systems, dual wheels, etc.;

* (d) If a product is being modified, a statement of the extent and features of the modification.

Each proposed special condition that is forwarded to FS-100 should be accompanied by full particulars and justification. The following is the type of justification frequently lacking:

(e) The exact nature of the novel or unusual design feature, including a showing, where appropriate, that the design feature would produce an unsafe condition unless the proposed special condition were applied;

(f) The relationship between the design feature and the applicable regulations, indicating how the standard is inadequate or inappropriate;

(g) A showing that the proposed special condition establishes a level of safety that neither raises nor lowers the standard set in the applicable regulations. *

(5) Washington Action. Upon receipt of proposed special conditions from the regional office, FS-100 will establish a regulatory project for processing the proposals. These will be evaluated for consistency with the applicable regulations and for uniformity in treatment with other special conditions. Within 30 days of receipt of the region's proposal, a copy of special conditions recommended by FS-100, together with an explanation of any changes recommended by FS-100, will be forwarded to the controlling regional office for final participation by the applicant and any other interested persons. A copy will be sent to GC-20 and may also be sent by FS-100 to other interested persons in the industry whose comment would be helpful. Upon receipt of comments, they will be evaluated by FS-100 and together with any recommendations for changes will be set forth in a project report transmitted through the Regulations Staff, FS-40, to GC-20 for legal drafting of the special conditions. The report will contain sufficient information to assist the Office of the General Counsel in determining the legal basis and justification for promulgating the special condition, and will include recommendations as to whether to publish the special conditions in the Federal Register, either verbatim or as a summary. GC-20 will prepare the legal draft of the special conditions after determining that all legal requirements have been met. The draft of the special conditions, after coordination, will be transmitted by FS-100 to the Director, FSS, for final action. Special conditions approved by the Director, FSS, are Federal Aviation Regulations of particular applicability and are filed in the Docket Section of the Office of the General Counsel, GC-24, and when determined appropriate, published in the Federal Register.

*c. Distribution of Copies. Copies of the adopted special conditions will be forwarded to the controlling regional office for their use and transmittal to the applicant. Other copies will be distributed to all Engineering and Manufacturing regional offices. The original of the special conditions will be filed in Docket Section.

d. General Applicability. Upon adoption, special conditions will be referred for study to determine whether they are generally applicable to other products. Periodically, those special conditions which are found to be generally applicable will be published in a notice of proposed rule making as proposed amendments to the airworthiness parts of the regulations. Pending adoption of amendments, a special condition may be proposed by the same or another controlling region for application to any subsequent design case which is similar to that generating the original issuance.

e. Changes After Original Issuance. As technical information is developed during the design and testing of a product, it might become appropriate to modify a previously issued special condition or to adopt a new one. The same procedure will be followed in amending a special condition or adding a new one as is used for an original issuance.

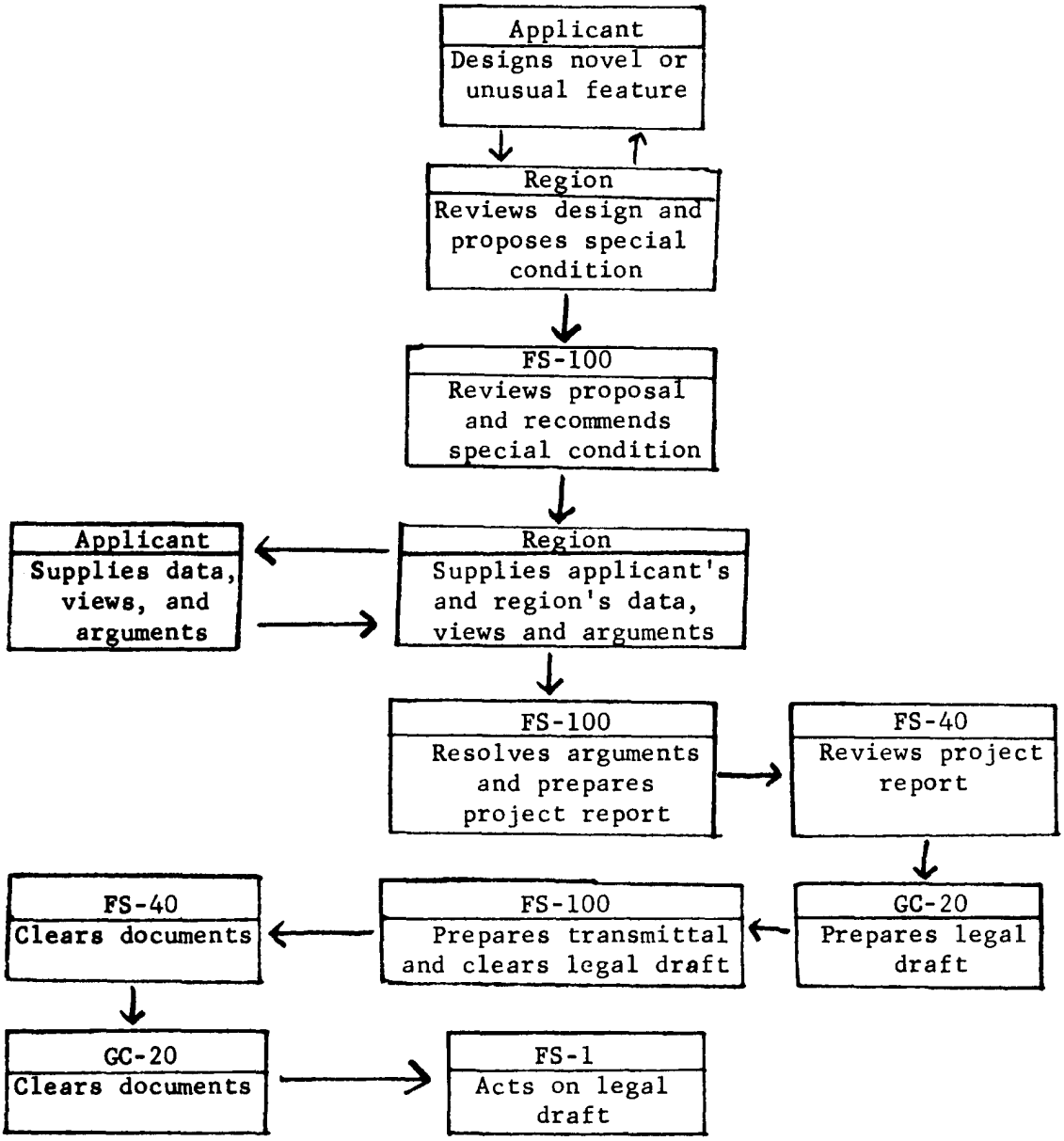
f. Flow Chart. The basic flow in the processing of a special condition, from the inception of the design feature by the applicant to the action taken by the Director, Flight Standards Service, on the recommended special conditions, is shown in a chart on page 4-4.*

9. CERTIFICATION OF IMPORT PRODUCTS.

a. Under the terms of existing bilateral agreements, the FAA is obligated to validate certificates of airworthiness for export issued by the competent authorities of foreign countries for civil aircraft subsequently to be registered in the United States. Such validation is accomplished by the issuance of a corresponding U.S. airworthiness certificate. Prior to such initial validation, however, the type design must be certificated. Section 603(c) of Federal Aviation Act of 1958 makes a type certificate a prerequisite for issuance of airworthiness certificates.

b. An applicant is entitled to a type certificate for a product manufactured in a foreign country with which the U.S. has an agreement for the acceptance of those products for export and import. (FAR 21.29). Those applications for type certification of aircraft for which a U.S. citizen has made application for registration and airworthiness certification should be given higher priority than those applications for products which have no known U.S. market.

PROCESSING OF SPECIAL CONDITIONS



c. The FAA provides counsel and advice to the foreign authorities, including pertinent special conditions as provided in the bilateral agreements. The FAA does not make the customary finding of compliance with the applicable standards but relies on the certification by the foreign country that the product has been examined, tested, and found to meet the requirements. The FAA does assure that the foreign authorities making such certification are competent, and provided with guidance and information necessary to proper determinations. Each regional office should be familiar with the terms of the bilateral airworthiness agreements for the countries under its jurisdiction.

10. TYPE CERTIFICATION BOARDS. Type Certification Boards will be established for all aircraft and engine projects in which complete type certification is involved; for propellers except fixed pitch; and for projects involving complex changes to the type design, when considered necessary. The basic function of the type certification board is to acquaint the applicant and the FAA with the certification projects, resolve problems of major significance and establish a schedule for the overall accomplishment of the type certification program.

11. SCHEDULE OF MEETINGS. Board Meetings are programmed according to need by the Chief of the Engineering and Manufacturing Branch in the region where the applicant is located. Generally, the number of Type Certification Board Meetings should be:

a. At least three for aircraft (preliminary, preflight, and final meetings).

b. At least two (preliminary and final) for engines and propellers, except if the proposed new model engine or propeller is generally similar to a previously certificated model and no unusual design features are presented, only the final meeting need be held.

c. Interim meetings should be held whenever the Chairman of the Type Certification Board considers it necessary.

12. PURPOSE OF MEETINGS.

a. Preliminary. The Preliminary Board Meeting is held to:

(1) Enable regional FAA personnel to become acquainted with the project.

(2) Permit discussion of design details and possible problem areas with specialists.

(3) Commence the evaluation process.

(4) Establish the basis and need for type certification.

* (5) Identify areas needing the formation of special compliance teams to attain the earliest possible resolution of potential problem areas through early emphasis and attention, for example; one such team shall be formed to determine compliance with cockpit visibility requirements. This team should consist of flight test specialists, at least one operations inspector and other engineering specialists as necessary.

b. Preflight. The Preflight Board Meeting (pretype inspection authorization for engines and propellers) is to discuss and clarify any questions the applicant may have, relative to the required flight testing of the aircraft (or the engine and propeller type testing program) and outstanding items of significance prior to the issuance of the type inspection authorization.

c. Final. This Meeting is held to:

(1) Review all outstanding items on which there may be some question of compliance with the established airworthiness standard.

(2) Establish the type certification data sheet items and airplane flight manual items (if applicable).

(3) Determine the status of any outstanding technical data. The issuance of the type certificate is dependent upon satisfactor disposition of all outstanding items.

13. BOARD MEMBERSHIP AND PARTICIPATION. The following are members of the Board and should be represented or invited to participate in specific phases of Board activity as required by the project under consideration. It is not mandatory that all members participate in every case.

a. The Chief, Engineering and Manufacturing Branch, in the region involved or his assistant will serve as Chairman except that, in the case of Engine or Propeller Board Meetings, he may designate the Chief, Propulsion Section, to serve as Chairman. The Chairman is authorized to convene the Board when considered necessary, and is responsible for securing the desired representation and notifying the representatives as to the time and location of the meeting.

b. The Chiefs of the Airframe, Systems, Propulsion, Flight Test, and the Manufacturing Inspection Sections of the region involved. With the concurrence of the Chairman, a Section Chief may, designate an employee of his Section to represent him.

c. A representative from each of the Operations, Maintenance, and Medical Branches. Medical Branch representation need not be invited in the case of Engine or Propeller Board Meetings. The Chiefs of the Operations and Maintenance Branches will each normally designate an air carrier or general aircraft inspector as appropriate. These representatives should be familiarized with the project during the development stages, in advance of Board Meetings, to ensure the Board of knowledgeable participants.

d. Other participants. Additional representatives should be invited to participate on an advisory basis when their presence is warranted

because of new features, specialized considerations, interregional and regulatory implications. These may include the following:

(1) Regional Engineering and Manufacturing Branch specialists within the Sections.

(2) Washington Engineering and Manufacturing Division officials and specialists.

(3) Other regions that may anticipate the first installation of the engine or propeller (for Engine and Propeller Board Meetings).

(4) Associated aircraft, engine or propeller manufacturer whose representatives may assist in providing technical information.

(5) Other Flight Standards Branches such as the Aircraft Services Branch.

14. WASHINGTON PARTICIPATION IN TYPE CERTIFICATION PROJECTS. The Regional Chief, Engineering and Manufacturing Branch, is responsible for requesting technical assistance or guidance from Washington in connection with a type certification project. Such a request should be made as far in advance as possible to facilitate work scheduling.

15. MINUTES OF TYPE CERTIFICATION BOARD MEETINGS. Minutes should be prepared to record each Type Certification Board Meeting. Two copies are to be forwarded to Chief, Engineering and Manufacturing Division, Washington Office, within two weeks after the meeting. The following format is recommended:

Subject: Minutes of (preliminary, preflight, final or interim) Type Certification Board Meeting.

Manufacturer:

Model and Project Number:

Location and Date:

Personnel Present:

Purpose:

Results: (Include major problems and actions to be taken thereto. Each item or subject discussed should be identified and summarized under a separate heading. The problem should be stated then followed by the conclusions, recommendation, or required action. Individuals participating in discussions should be identified by titles only.)

16. TYPE INSPECTION AUTHORIZATION.

a. FAA Form 8110-1 is to be issued when the examination of the technical data required for type certification is completed or has reached a point where it appears that the aircraft or component being examined will meet the pertinent regulations.

b. At the time the form is prepared, a letter of notification to the manufacturer should also be prepared and copies attached to all copies of the form. This letter of notification should serve two purposes: First, to notify the manufacturer that authorization for type inspection has been issued, and second, to completely summarize the status of the project so that there will be no question by the manufacturer or FAA personnel concerning what remains to be accomplished as a requisite for issuance of the type certificate.

c. The form, together with the letter of notification, should be coordinated with all persons concerned in the originating region with each section supplying the information relative to its portion of the inspection or authorization.

d. If a Type Certification Board is formed for the project, a rough draft of FAA Form 8110-1 may be prepared at the time of the first meeting. At the time of the Type Certification Board Preflight Meeting, the form should be completed or at least as nearly completed as the examination of the technical data will allow.

e. In case the technical data are examined in one region and the inspection is to be made in another region, the form should be initiated by the engineering unit examining the data and should be completed as nearly as possible in that region. The form should then be transmitted from the engineering organizational unit of the initiating region to the engineering organizational unit of the inspecting region for completion.

f. FAA Form 8110-1 should be used only for the purpose of authorizing official ground inspection and flight tests necessary to completely fulfill the requirements for type certification. It should be used for authorization of complete, supplemental or partial type inspection, the latter applying when a modification is made to a previously type-certificated article and ground inspection and flight tests are necessary. It shall not be used for the purpose of authorizing the witnessing of structural tests, inspection of processes, or related official actions. In such cases, authorization and instructions will be supplied by memorandum.

17. DISCONTINUANCE REPORT. When it becomes necessary to discontinue official FAA type tests for any reason, a letter shall be sent from the appropriate regional office notifying the applicant of the discontinuance and the reason for this action. The letter should cite the applicable FAR/CAR

and inform the applicant of the means by which the appropriate regional office is to be notified when the deficiency that caused the discontinuance has been corrected and a resumption of the type test is desired.

18. NOTIFICATION OF NONCOMPLIANCE. When items are found during ground or flight inspections that are not in compliance with the regulations but the type tests are not discontinued, the applicant is to be notified in writing of each noncompliance item found including reference to the specific regulation(s) applicable thereto.

19. RELEASE OF AND REFERENCE TO TECHNICAL DATA.

    a. The general policy regarding information disclosure is covered in OA P 1200.2.

    b. Reference to manufacturer's and certificate holder's data files by FAA engineering personnel is permissible and is not considered as infringing on the proprietary rights of the owner as long as the information is used solely by FAA engineering personnel to minimize the time and effort required for evaluation and is not disclosed to third parties who have not obtained permission from the original applicant.

20. PROCEDURES. The following are typical examples involving the release or other use of applicant's data.

    a. New Type Certificate or Supplemental Type Certificate. In order to establish compliance with the airworthiness requirements, an applicant for a complete new type certificate or a supplemental type certificate may wish to make use of data submitted by a previous applicant or holder of a type certificate. In such cases, the later applicant will be advised to obtain and submit to FAA the written consent of the earlier applicant. If the later applicant does not obtain such consent, he will either:

        (1) Be limited to a supplemental type certificate covering only the design changes which he substantiates himself, or

        (2) Be required to submit complete type design data and conduct all tests required by the applicable requirements; however, in this case, the FAA may reduce its own participation in the project to the minimum necessary to substantiate compliance with the airworthiness requirements. For example, instead of making a complete evaluation, the FAA may make spot-check comparisons of the later applicant's data with the first applicant's data.

    b. Altered Aircraft, Aircraft Engine, or Propeller. Alterations to aircraft may be approved on the basis of conformity to the supplemental type certificate data. To show conformity, the applicant for approval of the individual aircraft should have available copies of the

approved installation drawings, and instructions. However, the FAA representative making the approval is not responsible for determining how the applicant obtained this information.

c. Replacement and Modification Parts.

(1) The design data as defined by Federal Aviation Regulations, Section 21.31, submitted to the FAA to substantiate airworthiness for the certification of a product is part of the type certificate. This data should be retained in files of the FAA but may be retained by the type certificate holder providing he agrees to maintain it in the currently approved status and make it available to FAA at all times without restriction.

(2) Type design data submitted to FAA for approval shall not be disclosed without the written consent of the owner or as permitted by the provisions of Section 3 of the Administrative Procedure Act, as revised effective July 4, 1967, and Sections 902(b) and 1104 of the Federal Aviation Act of 1958.

(3) Any person may apply for design approval for modification or replacement parts for use in a certificated product. The FAA responsibility, in such cases, is to determine that the modification or replacement parts conform to the approved type design or to the applicable standards. The use of the approved type design data solely by the FAA for determining conformity of design data submitted by any applicant is not considered to be public disclosure of information.

(4) The FAA will not question the source or method by which an applicant, for a modification or replacement part approval, obtains his design information.

(5) A modification or replacement part approval may be granted when the applicant demonstrates that the modification or replacement part is identical to that of the approved type design.

(6) When the applicant does not show identicality with the approved type design, for parts other than those covered by Section 21.303(b) of the FAR or when, in the opinion of FAA, identicality of design does not substantiate an equivalent level of safety, there can be no approval based on comparison of data. In such instances, no disclosure shall be made of the nonconformity nor of any aspects of the approved type design data. The applicant will be informed that his design data does not comply with the approved type design and that he may substantiate his design by tests or other means of substantiation as provided in FAR, Section 21.305, if he wishes to pursue his request for design approval.

(7) Each region granting FAA-Parts Manufacturer Approval (PMA) fabrication system approval should maintain a summary of all replacement parts approved within the region for use on all type certificated products under the FAA-PMA system. Information on the name and address of the PMA holder, the part number of PMA part(s), and the type certificated product(s) in which part(s) is approved should be supplied to the public upon request. In the interest of minimizing the expenditure of FAA manpower, interested parties may be referred to the other regional offices and the PMA holders when the desired information is not available in the region receiving the request.

d. Release of Data when a Type Certificate is Cancelled or the Holder of a Type Certificate Goes Out of Business Without Transferring it. The data pertaining to such certificates may be made available to any person who appears to have legitimate need of the information to properly maintain aircraft of the type involved. However, if manufacturing is involved, the case should be referred in accordance with Handbook 1200.2A, Public Availability of Information.

*21. SPECIAL CERTIFICATION REVIEW. A Special Certification Review (SCR) is an in-depth comprehensive review of complex, controversial, or troublesome aircraft design features, or aircraft component problems associated with airworthiness determinations for an aircraft, engine, propeller, or aircraft component. The SCR is an auxiliary means of determining compliance with the applicable type certification requirements and should be conducted concurrently with the standard regional type certification program. An SCR can also be used to evaluate troublesome design features on previously approved products.

a. Examples of potential safety problem areas for which an SCR may be appropriate include the following:

(1) Complex/unique design features.

(2) Advanced state-of-the-art concepts in design/quality/mfg.

(3) Features that may require special conditions.

(4) Troublesome features used on similar previous designs requiring further analysis/evaluation.

(5) Compliance areas critical to safety and requiring judgement evaluations.

(6) Undesirable maintainability characteristics. *

* (7) Equivalent safety proposals with potential for major effects on safety.

(8) Complicated interrelationships of unusual features.

b. Consideration of an SCR in the certification process is a mandatory procedure, and an SCR shall be conducted when it has been determined that a potential/existent safety problem, has occurred or could occur. The consideration shall be made for all certification programs, including major changes to the type design of previously certificated products, and in evaluating certificated design features that have adverse service experience.

c. Requests for an SCR will normally be initiated by the certificating regional engineering and manufacturing offices, although other offices may propose an SCR to that office. All requests must be submitted to the Chief, Engineering and Manufacturing Division, AFS-100, for coordination and approval.

d. Based on knowledge of the design feature or potential safety problem obtained from Type Certification Board (TCB) Meetings, the Chairman of the TCB shall identify those certification areas, if any, for which an SCR is deemed appropriate. The Chief, Engineering and Manufacturing Branch/Aircraft Engineering Division of the applicable region will advise the Chief, Engineering and Manufacturing Division, AFS-100, of the desired SCR(s), along with his recommendations for the composition of the SCR team including the proposed chairman. AFS-100 will provide guidance and assistance as needed. SCRs may be initiated at any time during the type certification program, or as service experience dictates.

e. The SCR team may be comprised of FAA personnel from the certificating region, Washington and other regions if appropriate. The team may utilize assistance from governmental agencies, outside consultant firms, and industry, as necessary to obtain the technical expertise for conducting a thorough evaluation. Caution must be exercised relative to the applicant's proprietary rights when non-FAA employees participate in an SCR. Normally, the SCR will function in conjunction with and under the jurisdiction of the TCB, although an SCR need not be conducted concurrently with a Type Certification Board Meeting, and may be initiated at any time to deal with service difficulties.

f. The SCR will include examination of the applicant's data, discussion with FAA Regional Office personnel and the applicant's personnel, inspection of the prototype or production article(s), and any other means available to the team, as necessary, to perform a complete and comprehensive evaluation consistent with the purpose of the review. Every significant aspect and ramification of the *

* potential safety problem in question should be fully explored, including the adequacy of the pertinent regulations and policy material.

g. The SCR Chairman will be responsible for preparing a report of the team's findings and recommendations to the Chief, Engineering and Manufacturing Branch/Aircraft Engineering Division of the certification program, who will be responsible for appropriate and effective action. A copy will be forwarded to Washington (AFS-100) for use in developing possible regulatory changes or guidance material to the regions.

h. It is intended that by-products of an SCR will include (1) a detailed review and evaluation of the pertinent existing certification requirements, (2) recommendations for revisions if appropriate, and (3) improvement in effecting uniform application of the certification rules throughout all regions.

22. VISITS TO AIR CARRIER FACILITIES.

a. Visits should be made to scheduled U.S. air carriers by engineering representatives from the region responsible for FAR 25 and FAR 29 type certification of aircraft and engines used by the operator. The objective is to obtain firsthand knowledge of the effectiveness of the related regional certification and continued airworthiness efforts, and to gain a better understanding of the operators' problems and activities. These visits should encompass a review of current service difficulty or safety problems and the need for corrective action, problems that may exist with airworthiness directive requirements, adequacy of the approved airplane flight manual, operational restrictions that differ from Federal Aviation Administration limitations, an understanding of the operators' inspection and modification programs, and how to improve liaison between maintenance and FAA engineering. Emphasis should also be placed on continued airworthiness procedures for the extended use of older aircraft.

b. Visits should be scheduled to the most active operators at least once a year. It is desirable that all operators utilizing the regions' certificated products be visited at least once every 3 years. In planning the visits, consideration should be given to selecting engineers best qualified for making the visits, requesting maintenance participation, and requesting regional participation if visits are made to operators in other regions, etc. Prior to visits to operators facilities, all arrangements with the air carrier for such visits should be made by the appropriate FAA ACDO/FSDO. All requests to arrange visits should be made through the Flight Standards Division Chief having purview over the operator to be visited, who in turn will pass the request to the ACDO/FSDO having the operators certificate responsibility. The operator should be*

informed of the number of visitors, dates of arrival and departure and tentative agenda and/or discussion topics.

* 23. FACTFINDING INVESTIGATIONS.

a. Reports of violations or allegations of noncompliance may be received after a type certificate is issued. Complainants should be requested to furnish full facts in evidence to support any allegations of noncompliance; however, since such complaints shall not be taken lightly and depending on the circumstances and the absence of facts, a factfinding investigation may be necessary to develop evidence. The objective of a factfinding investigation is to obtain information necessary to decide what agency action, if any, should be taken. Even without an external complaint, the agency may determine that this type of investigation is necessary. In either case, arrangements should be made with the Chief or Regional Counsel to issue an ORDER OF INVESTIGATION in accordance with Order 8030.7A.

b. The factfinding investigation is prescribed under Sections 313, 1002(a), or 1002(b) and 1004 of the Federal Aviation Act and 6(b) of the Administrative Procedures Act. It is an investigation in which the compulsory processes of Section 1004 of the Federal Aviation Act are instituted and used to assist the agency in finding material facts to exercise its functions. This procedure is not to be used either as a substitute for a routine investigation or to investigate violations which constitute felonies under federal law. *

SECTION 2. TYPE CERTIFICATES

24. TYPE CERTIFICATE.

a. An aircraft type certificate (TC) will be issued after all outstanding items have been resolved, the airplane flight manual (where required by regulation) has been approved, and the type certificate data sheet prepared. A copy of the TC data sheet must be attached to the TC when it is presented to the applicant.

b. All type certificates are prepared on FAA Form 8110-9. The following are general instructions on the preparation of the form.

(1) Above the line "Type Certificate" type in the kind of component, using capital letters, i.e., AIRCRAFT, ENGINE, PROPELLER. For products approved under the provisions of FAR 21.29 (CAR 10) the word IMPORT should be typed under the line "Type Certificate".

(2) To the right of the line "NUMBER", type in the number. The number will consist of three elements; first, a letter symbol to identify the article; second, a serial number to be assigned by the region; and third, a symbol to indicate the region in which prepared.

NOTE. The serial number assigned by the region will be from a series to be established for each kind of type certificate. In other words, a series of numbers should be established for each letter symbol. Thus, the first airplane type certificate issued in the Eastern Region would be numbered "A1EA" and the first glider type certificate would be "G1EA".

(3) To the right of the line, "This certificate issued to," the applicant's name should be inserted. The address of the applicant is not shown. The name used should agree exactly with that shown on the application for type certificate.

(4) In the space following the word "PART" show the applicable FAR/CAR.

(5) In the space below the paragraph ending in "Regulations" show the product type designation, as "Airplane Model 120". Where a second model is later added, the line would be "Airplane Models 120 and 140". If the models added become too numerous to fit into this space, an extra page may be attached to the FAA Form 8110-9. The notation should be added "See attached sheet for additional models". The sheet should be identified at the top - "Sheet 2 of Type Certificate _____".

(6) Date of issuance. When models are added later, the original issuance date will still be shown and the new date indicated under it; for example:

"Date January 31, 1965
Model 140 approved June 10, 1966"

(7) When a type certificate is revised for the purpose of issuing it in the name of a different owner or where a duplicate copy has been requested, the date should not be changed.

(8) The type certificate is signed by, or for, the Regional Chief, Engineering and Manufacturing Branch.

c. Aircraft type certificates are, at present, of four kinds; namely, airplanes, helicopters, airships, and gliders. The nomenclature used herein should be used in the type certificate and the symbols to be used in the number are as follows:

Airplanes	A
Helicopters	H
Airships	AS
Gliders	G

d. Engine and propeller type certificates will have the symbols "E" and "P" respectively.

e. Concurrent with the issuance or reissuance to add a new model of a type certificate, telegraphic notification of such issuance will be sent to the Chief, Engineering and Manufacturing Division, FS-100. **(Notification of Type Certificate Approvals RIS: FS 8110-1).**

f. File copies of type certificates are made on bond copies of FAA Form 8110-9. A copy must be retained in the regional office for official record purposes.

25. CANCELLATION OF INACTIVE TYPE CERTIFICATES. A type certificate may be canceled upon request of the TC holder. Upon surrender of a type certificate for cancellation, the word "canceled" is stamped or typed on the body of the certificate together with the date and the signature of the Regional Chief, Engineering and Manufacturing Branch. An appropriate notation should be made on the file copy of the certificate and a memorandum addressed to the Washington office advising of the cancellation. The canceled original certificate is then returned to the holder for his file. An appropriate notation must be made on the pertinent specification or type certificate data sheet.

26. TRANSFER OF TYPE CERTIFICATES. Upon receipt of a properly endorsed certificate for transfer, a new certificate should be issued in the name of the new holder. The only other change should be an entry under

"Date of Issuance" to show date reissued, i.e., _____February 5, 1962 (Reissued to Fairchild). The TC data sheet also should be revised accordingly.

27. PROVISIONAL TYPE CERTIFICATES. The FAA Form 8110-9 is used for provisional type certificates. The same number is used for the provisional and the final TC. The word PROVISIONAL should be typed above the line TYPE CERTIFICATE. The line near the bottom of the form relative to transfer should be obliterated since provisional certificates are not transferrable.

28. TYPE CERTIFICATION PROJECTS. A type certification project should be established for and a number assigned to each project involving any phase of type certification.

29. STATUS OF TYPE CERTIFICATION PROJECTS (RIS: FS 8110-3).

a. Each Engineering and Manufacturing Branch should maintain a list of its type certification projects. A copy of the list, giving the status of current projects should be sent quarterly to the Chief, Engineering and Manufacturing Division, Washington, and the Engineering and Manufacturing Branches in the other regions. A supplemental report, listing new projects and giving the dates of approval or cancellation of projects, should be submitted to Washington and the other regions monthly by the 10th of the month.

* b. Samples of the forms to be used by the regions in setting up the project status list and the type project identification code, are shown in Appendix 1, Figures 2-1 and 2-2. With all regions using the same forms it will be possible to assemble a complete listing of all projects in all the regions easier. FAA Form 8110-13, Type Certification Projects Status, can be obtained from the FAA Depot (Aeronautical Center) by referring to Federal Stock Number 0052-803-5000. *

30. TYPE CERTIFICATE DATA SHEET.

a. The type certificate data sheet is the part of the type certificate setting forth the limitations prescribed by the applicable airworthiness regulations and any other limitations and information found necessary for type certification.

b. The project engineer should endeavor to have a complete type certificate data sheet as soon as possible after approval of the engineering data. The format of the type certificate data sheet and many of the items can be in a partial state of completion at the time of issuance of the Type Inspection Authorization (TIA). Final entries may have to await the information which will appear in the Type Inspection Report (TIR). The data sheet must be completed by the time the TC is issued. An information copy of the data sheet should be sent to Washington (FS-100) within 48 hours after issuance of the TC.

31. DETAILED DESCRIPTION.

a. Heading -- Numbering. The data sheet number will appear in the upper right-hand corner of page 1. This number will be the same as the type certificate number. When the data sheet is revised, the revision number will be shown. The name of the type certificate holder, in abbreviated form, will be included next together with all of the approved models listed in alphabetical or numerical order for convenience in filing. The issue date will complete this group which then will be enclosed in a box to set it off.

b. Title. The title of the document will appear in the center of the page as "TYPE CERTIFICATE DATA SHEET NO. XXX."

c. Type Certificate Holder. The applicant's name and city address inserted opposite the words "Type Certificate Holder" should agree exactly with that shown on the application for type certificate.

d. Sections.

(1) One or more sections will follow the identification of the type certificate holder, each section being confined to an individual model of the general type covered by the type certificate. The section covering each model will be headed by a Roman numeral followed by the model designation which should also be taken from the application for type certificate. The category or categories in which the aircraft may be certificated will appear in parenthesis following the model designation. This is followed by the approval date which is the date shown on the type certificate.

(2) When it is practical to do so, the differences between the new model added to the data sheet and a previously approved model will be indicated immediately below the heading for the new model. This information is to assist in determining the eligibility of a conversion from one model to another.

32. INFORMATION REQUIRED FOR EACH MODEL. Each of the items listed herein will appear in the data sheet exactly as entitled. Where several models are included under the same type certificate, the items must be repeated under each section with the exception of the datum, mean aerodynamic chord (MAC), leveling means, control surface movements, production basis which, if common to all models, may be listed under "Data Pertinent to All Models."

a. Engine. The abbreviated name of the manufacturer and complete model designation for all engines for which the aircraft manufacturer obtained approval will be shown together with reduction gear ratio and order of dynamic dampers when required.

b. Fuel. The minimum fuel grade to be used in the basic engine will be shown. Where optional engines are included, the fuel grade will be included with the pertinent limits.

c. Engine Limits. The maximum continuous and takeoff ratings of the engine described, including manifold pressure (when pertinent), r.p.m., and hp. will be shown here. The rating may be less than, but must never exceed, the rating for the engine as shown on the pertinent engine specification. Any reduction will be dictated by structural, vibrational, performance, or other requirements. In the case of altitude engines, i.e., supercharged engines, the ratings will be shown for sea level and for critical altitude or altitudes, and a statement included regarding variation between altitudes such as "straight line manifold pressure variation with altitude to 10,000 feet." For the smaller sea level engine whose maximum continuous and takeoff ratings are identical, the expression "for all operations" normally will be sufficient.

d. Propeller and Propeller Limits. The abbreviated name of the manufacturer and model designation for each propeller for which the aircraft manufacturer has obtained approval will be shown together with the propeller limits and any operating restrictions peculiar to the propeller or propeller-engine combination.

(1) The fixed pitch propellers, the static r.p.m. limits and diameter limits must be shown. The static r.p.m. limits will include the plus or minus r.p.m. tolerance. Thus, if the TIR indicates in a given case that the r.p.m. limits must be 2250-2300, the data sheet will indicate as follows: "Static r.p.m. at permissible throttle setting, not over 2350, not under 2200. No additional tolerance permitted." Thus all tolerance permitted is indicated in the basic limits.

(2) For adjustable, two-position, controllable, and automatic propellers, the diameter limits, blade angle settings (feathering, high, low, and reverse as applicable) must be shown. The applicable static r.p.m. limits (with tolerances) may also be shown if considered desirable. The diameter limits should include both maximum limit and the minimum allowable for repairs with a notation "No further reduction permitted."

(3) Additional information is required in certain circumstances such as the following:

(a) Where propeller blades are not an integral part of the hub, the model designation of both the hub and the blades will be included.

(b) Interchangeable blades will be listed or a note included indicating where a listing of the other eligible blades may be found.

(c) For propellers which permit the blade angle setting to be varied, the reference blade station at which the angle is measured must be given.

(d) Some engines may incorporate different reduction gear ratios or different types of reduction gears without a change in model designation. In such cases, the gear ratio should be shown since the propeller stresses are influenced by the reduction gearing. Where only one engine model and one propeller model are approved for the aircraft, items appropriate to the engine, such as reduction gearing and dampers, will logically be included under the engine model both for flight performance considerations and for propeller limits and vibration stress consideration. All of the following conditions will be included when pertinent: reduction gear ratio, unusual type reduction gear such as "spline type reduction gear," order of the dynamic dampers in the engine, incorporation of balancers in the engine, restricted r.p.m. operating regions whether on the ground or in flight, allowable maximum gross weight, and any flight speeds or airplane altitudes that must be observed. In the case of automatic propellers, it may be necessary to specify additional factors to insure a satisfactory installation and adequate performance.

(e) The manufacturer's name and model designation of the spinner when used.

(f) The manufacturer's name and model designation of propeller deicer, anti-icer accessories, governors, synchronizers, etc.

e. Airspeed Limits. All pertinent airspeed limits will be shown in both m.p.h. and knots. The terminology for each speed will be the same as that used in the CAR/FAR under which the aircraft is type certificated.

f. Center of Gravity (C.G.) Range. The C.G. approved for the extreme loading conditions of the aircraft will be given in inches from the datum. Dimensions will be carried out only to the nearest tenth of an inch. The range may be stated also in percent MAG for T-category aircraft only. Where the landing gear is retractable, values will be given in terms of landing gear extended and a statement added to that effect. The moment change (in inch pounds) due to the retracting of the landing gear also will be included. In the case of unconventional aircraft or T-category aircraft where the C.G. limits vary with loaded weight, no specific standard for presentation can be set. The pertinent information may be tabulated or set forth in any other form which will be unmistakable.

(1) For non-T-category models, it is desirable that a single C.G. range (square envelope) be used for all weights. In deciding whether or not to list a simplified C.G. range, a study of the TIR, weight and balance report, and C.G. envelope will be made. The factors to be considered are:

(a) The equipment and ballast (if any) installed forward of the forward limit with consideration of possible additional equipment that might be added forward.

(b) The relative positions of the front C.G. limit and the normal empty weight C.G., i.e., how likely is a loaded C.G. to approach or exceed the "cutoff area" of the C.G. envelope, taking into account reasonable additions of equipment and changes in service.

(c) The effect on safety if the front C.G. limit were exceeded by a small amount.

(2) The following conditions are prerequisites of any consideration of "squaring up" the C.G. envelope:

(a) The rear C.G. limit as indicated by the TIR must be constant for all weight, i.e., the right-hand edge of the C.G. envelope must be a straight vertical line.

(b) The cutoff area for the forward C.G. must not be too great, i.e., the highest weight at which the most forward C.G. is permissible must be about 80-90 percent of the maximum approved weight.

(c) The structural design C.G. envelope must either be square or of sufficient area to include a square final envelope.

g. Empty Weight C.G. Range. An attempt must always be made to establish an empty weight center of gravity range for personal type airplanes. If no range exists, the condition will be indicated by inserting the word "none" after the heading. The range will be given as fore and aft limits in inches from the datum. Where it is affected by items of equipment, full explanation must be included. Where an empty weight C.G. range is established, the following statement will be inserted:

> When the empty weight C.G. falls within the range given, complete computations of critical fore and aft C.G. positions are unnecessary. Range is not valid for nonstandard arrangements.

The wording may be modified to suit the individual case.

h. Datum. The datum, designated by the applicant, must always be a definite, unmistakable, and unchangeable point. It must be defined in such manner that it may be readily identified.

i. Mean Aerodynamic Chord (MAC). The MAC and leading edge of MAC in inches from datum will be shown when the center of gravity range is expressed in percent of MAC on T-category aircraft only.

j. Leveling Means. The description of the means provided for leveling the aircraft will be included with information as to its general location and accessibility.

k. Maximum Weights. All pertinent maximum weights, including ramp, landing, takeoff, zero fuel and oil and antidetonant injection (ADI) fluid gross weights, and for 3-engine ferrying operation will be included together with information on fuel dump valves when required. If the explanatory material appears cumbersome, it may be included in a note which will be cross-referenced under the item.

l. Minimum Crew. When established by regulation, the minimum crew required for normal operation will be included. Other conditions may be shown when appropriate.

m. Number of Seats.

(1) Passenger Capacity of T-Category Aircraft. The passenger capacity of T-category aircraft approved under CAR 4b (or applicable FAR) may be limited by either the emergency exit requirements, demonstration of emergency evacuation procedures, or by the structural strength of the floor. Cabin attendants are not considered in the maximum number of passengers and are not to be listed.

(2) Number of Seats in Aircraft Other than T-Category. The number of seats and the moment arms of the seats will be indicated. The seat moment arms ordinarily will be those of the occupants of the seats rather than the seats. The occupant's C.G. may be assumed at a point 10 inches forward and 10.5 inches above the intersection of the seat back and the seat bottom with the upholstery compressed approximately the same as when the seat is occupied. Ordinarily, the moment arms of adjustable seats will be given for the mean or average location, but where the C.G. range is critical, the extreme positions may be defined.

(3) Cargo Only. If the aircraft is approved for cargo only the number of seats should be shown as: None. Approved for cargo only.

n. Maximum Baggage. The maximum capacity and moment arm of each baggage compartment will be shown. The maximum capacity is the

actual capacity of the compartment. It is not the maximum allowable for the individual airplane which often may be less due to weight and balance consideration or location of equipment. For the larger type aircraft, floor loading densities will be listed.

o. Fuel Capacity. The total capacity of each fuel tank installed in the airplane and its moment arm will be indicated. Where only part of the fuel capacity is usable and weights are indicated for system fuel and oil, the pertinent information will be contained in NOTE 1 and cross-referenced under this item. The reference will read: "See NOTE 1 for data on system fuel and oil". Where usable fuel in the tank differs from total fuel capacity, the usable fuel quantity will also be indicated so that the quantity marked on the fuel-filler cap will be shown. However, it is also necessary that the total capacity be shown since the most frequent use of this information is for weight and balance purposes.

p. Oil Capacity. Same as fuel capacity.

q. Maximum Operating Altitude. (When appropriate.)

r. Control Surface Movements. The total one-way travel in each direction of each movable control surface on the aircraft will be included. This information is included only as a convenience to overhaul and repair stations and to FAA representatives. It should be noted that it is not intended to prescribe these control movements as an item of inspection unless a specific statement to that effect is included. Where the flight characteristics of the aircraft require close tolerance on the control movements, it will be mandatory that the method of measuring the movements be set forth so that the individual using the information may make accurate measurement. In such cases, it will generally be found more satisfactory to list the maximum movements in terms of inches from some well defined point rather than in degrees. Where degrees are used, the point of measurement will be specified.

s. Manufacturer's Serial Numbers.

(1) The manufacturer's serial numbers for each aircraft under a particular model will be included. The numbers listed should appear on the manufacturer's aircraft nameplate in exactly the same form.

(2) When an airplane of one model is modified in the field by installing an engine which is approved under another model of the same manufacturer and type, it is the policy to change the aircraft model designation provided the modified airplane conforms entirely to the data for the new model. This conformance includes the serial number; consequently, if there should be any reason why the model change should not be made, it should be specifically prohibited by the serial number group.

(3) When the manufacturer's serial numbers are unknown at the time certain surplus military airplanes may be found eligible for civil certification, the military serial numbers may be indicated provided the following statement is included: "Use manufacturer's serial number if available."

(4) When the manufacturer elects to adopt the delegation option procedure for an aircraft model originally type certificated in accordance with standard procedure, the following statement will be included: "The manufacturer is authorized to issue airworthiness certificates for airplane serial numbers XXXXX and up under the delegation option provisions of FAR 21."

(5) Should the type certificate holder request cancellation of the type certificate, a statement will be included to the effect that only airplanes manufactured prior to the date of expiration of the type certificate are eligible for certification.

t. Import Requirements. For imported aircraft, describe the document to be used by the country of manufacture in certifying, per FAR 21.183(c), that individual aircraft conform to the type design and are in a condition for safe operation. This document is the basis for determining the eligibility of a foreign aircraft for a U.S. airworthiness certificate; therefore, it is essential that the description be clear and complete.

u. Certification Basis.

(1) The certificate number, together with a statement regarding the requirements and/or special conditions with which the aircraft has been shown to comply and the effective date of the pertinent FAR/CAR, will be included. In addition, for each change in the type certificate which is accomplished in accordance with regulations other than those recorded at the time of issuance of the type certificate, the applicable regulations will be recorded under this heading.

(2) If the manufacturer has obtained a type certificate under the delegation option procedure, a notation to that effect will be included.

(3) Where compliance with pertinent ditching provisions and ice protection criteria for T-category aircraft has been demonstrated, it will be so indicated in this section.

v. Production Basis.

(1) If a production certificate has been issued to the type certificated holder, listing of the production certificate and number

will be sufficient except when the certificate is issued under the delegation option procedure in which case the following statement will be included: "Production certificate issued and the manufacturer authorized to issue airworthiness certificates under the delegation option provisions of FAR 21." Where production is carried on by a licensee of the type certificate holder, the situation will be explained.

(2) If no production certificate has been issued, the following entry will be made: "None. Prior to original certification of each aircraft, a FAA representative must perform a detailed inspection for workmanship, materials, and conformity with the approved technical data, and a check of the flight characteristics."

(3) In case the production certificate is canceled and type certificate remains active, the production status will be defined as follows: "None. Prior to original certification of each aircraft manufactured subsequent to (date of cancellation of production certificate), an FAA representative must perform a detailed inspection for workmanship, materials, and conformity with the approved technical data and a check of the flight characteristics."

w. Equipment. The following statement should appear: "The basic required equipment as prescribed in the applicable airworthiness regulations (see Certification Basis) must be installed in the aircraft for certification." If additional or special equipment is found necessary for type certification or if exceptions to the prescribed minimum equipment are permitted, these should be listed. Alternates to equipment found necessary for certification shall be listed. Optional items of equipment, except engines and propellers for which the aircraft manufacturer obtains approval, will not be listed on the type certificate data sheet but will be shown on the equipment list supplied by the manufacturer with each aircraft. Approvals of equipment installations obtained by parties other than the type certificate holder may be listed in the publication, "Summary of Supplemental Type Certificates."

33. NOTES.

a. The use of notes should be avoided whenever possible. Pertinent explanatory material will be included with the item to which it refers. The practice will be followed even though it becomes necessary to repeat the information several times. Only where the length or complexity of the material renders such procedure highly impractical will the information be contained in a separate note. It then will be necessary to include with the pertinent items a reference to the note.

b. When a note is referenced, the reference will always indicate the material which will be found in the note. An example of cross-reference would be the following notation inserted after the fuel capacity: "See NOTE 1 for data on unusable fuel."

c. In the preparation of notes, the need for care in choosing the language to be used cannot be overemphasized. Many difficulties have arisen in the past due to misinterpretation of information included in the notes; consequently, the material should be carefully examined to insure that the meaning is unmistakable.

(1) NOTE 1 should be reserved for the "weight and balance note." This note pertaining to weight and balance data and the equipment lists and loading instructions, where necessary, is standardized except for special considerations regarding weight and balance which should be included; for example, information on unusable fuel or system fuel and oil or variations in center of gravity ranges. The standardized part of this note reads as follows:

> Current weight and balance report including list of equipment included in certificated empty weight, and loading instructions when necessary must be provided for each aircraft at the time of original certification.

(2) NOTE 2 should be reserved for a list of required placards including the one regarding operation in compliance with the operating limitations when applicable.

(3) NOTE 3 should be reserved for referencing service life limits on structural components established during type certification. These limits must be placed in the aircraft flight manual, on the required listings or placards, or in a required maintenance manual, and referenced on the type certificate data sheet. The document referenced on the type certificate data sheet must be specifically identified by title (and section if appropriate), date, and include the statement that the limitations may not be changed without FAA engineering approval. Revisions to the referenced document and the type certificate data sheet must be made for any changes (either restrictive or relaxatory) in service limits. An airworthiness directive also must be proposed for more restrictive limitations. Where a maintenance manual is required, the note shall state that information essential for proper maintenance is contained in it.

d. For aircraft certificated under regulations requiring an operating limitations placard, it will not be necessary to list required placards in NOTE 2 with the exception of the one required in the regulation provided the placards are included under the applicable

items or in the form of other placards, markings, and manual. However, if any required placard is not covered elsewhere, it must be included in the note.

e. For aircraft requiring an airplane flight manual, the following statement should appear: "All placards required in the approved airplane flight manual must be installed in the appropriate locations." If any required placard is not listed in the manual, it must be listed in the note.

34. MISCELLANEOUS NOTES. Such additional notes as are needed to convey necessary information not provided for elsewhere.

35. PREPARATION OF TYPE CERTIFICATE DATA SHEETS AND SPECIFICATIONS FOR PRINTING.

* a. Within two weeks after issuance of a type certificate, the master for printing the Type Certificate Data Sheet or Specification is to be typed in final form in the issuing region and forwarded to the Aeronautical Center, Attention: AFS-513, where it will be processed for printing by the U.S. Government Printing Office. All material received by the 15th of the month will be included in the publication for that month.

b. Type the masters on smooth finish, opaque, white bond paper of sufficient weight and substance to withstand frequent handling. Material shall be typed on one side only on either 8 x 10 1/2 inches or 11 x 15 inches paper size. The latter size is preferred; however, the 8 x 10 1/2-inch size is acceptable when the data sheet or specification is short and uncomplicated in format. The text should be prepared in 10 or 12 pitch, sanserif type style. An electric typewriter with carbon ribbon is preferred; however, a standard typewriter is acceptable provided it produces a black image suitable for reproduction by xerography, photo offset, or microfilming. Copy density shall be uniform throughout the page. When corrections are required in the process of preparing the master, correction-fluid, -paper, or -tape is permitted.

c. The Type Certificate Data Sheets and Specifications will be published with a final trim size of 8 1/4 x 10 3/4-inch paper and in looseleaf form for insertion of standard 3-hole binders. Therefore, when using 8 x 10 1/2-inch paper the allowable typing area must not exceed 6 5/8-inches in width by 9 1/2 inches in length. When 11 by 15-inch paper is used the allowable typing area must not exceed 9 3/4 inches in width by 14 inches in length. The latter size paper will be photo-reduced for publication to 6 5/8 x 9 1/2 inches. When typing the masters, 1/2-inch of clear space may be left between sections of equipment where it is anticipated that new items may be added. Information appearing under each heading should not be broken unless it is necessary to keep the text within the allowable typing area for the size of paper used.

*

* d. The original will be forwarded to AFS-513 for preparing negatives. After the negatives have been made, the original will be returned to the controlling region.

e. In lieu of submitting the original, lithographic negatives may be prepared in the controlling region and forwarded to the Aeronautical Center, AFS-513. This procedure is not the most desirable, however, because of the risk of the negatives not being acceptable to the Printing Branch, Washington, D.C. It also precludes the possibility of minor corrections being made. Negatives will not be returned to the controlling region. When preparing negatives, the typed material, including change marks, must be reduced to 6 5/8" x 9 1/2". Further reduction in proper proportion is permitted only under unusual circumstances.

f. The Type Certificate Data Sheets and Specifications are printed by the Government Printing Office; consequently, abbreviations and compound words must be as indicated in the GPO Style Manual and those contained in the FAR's. Some of the proper abbreviations for terms commonly used in the data sheets are listed below: *

a., ampere	p.s.i., pounds per sq. in.
b. hp., brake horsepower	p.s.i.a., pounds per sq. in. absolute
C., centigrade (Celsius)	p.s.i.g., pounds per sq. in. gage
cu. ft., cubic foot	pt., pint(s)
cu. in., cubic inch	qt., quart(s)
F., Fahrenheit	r.p.m., revolutions per minute
ft.-lb., foot-pound	s. hp., shaft horsepower
gal., gallon(s)	sq. in., square inch
g.p.m., gallon per minute	v., volt
hp., horsepower	vol., volume
in.-lb., inch-pound	w., watt
m.p.h., miles per hour	

g. Commonly used compound words such as "takeoff," "copilot," "deicing." "deicer," "turbojet," and "turboprop," should not be hyphenated unless the last vowel in the prefix is followed by the same vowel, such as "anti-icer." The number mark (#) should not be used as an abbreviation for pound(s) except in a tabulation where space is limited. Neither the number mark (#) nor the percent mark (%) should be used for footnote purposes. The asterisk mark (*), double asterisk (**), etc., may be utilized. These instructions should be followed in both data sheets and specifications.

h. The first page of the Type Certificate Data Sheet or Specification will not have a page number. The succeeding pages will be numbered consecutively in the center at the top of the page and the data sheet or specification number will be included on the same line, flush with the right-hand margin on odd numbered pages, and flush with the left margin on even numbered pages.

* i. When revising a data sheet or specification, identify the revised material by placing a change mark (a vertical black line) along the left-hand margin of the page opposite that portion of the printed matter that was changed. If the change marks on a page are so numerous they lose their significance, a vertical black line may be placed opposite all the printed matter on that page . When a new model is approved, the model designation will be inserted in proper order and a change mark placed between the new model and the enclosure.

j. Since it is important for the user to know the revision status, the issuing office will include the revision number below the data sheet or specification number on each page revised. In the enclosed box on the first page, add the revision number directly below the data sheet or specification number and enter the revision date at the bottom of the enclosed box. Also, add a revision control chart, of the type shown below, to the bottom of the first page. If needed, additional charts may be placed underneath the first one. Insert the page number in the upper block and enter the revision number of that page in the lower block. Place a dash (-) in the lower block for those pages which have not been revised. When initially adding the revision control chart to data sheets or specifications that have been previously revised it will be necessary to place a revision number on those pages which do not already have one shown and transmit those pages, along with the ones actually revised, for publication. If the individual status of each page cannot be determined use the revision number of the currently published data sheet or specification.

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k. Revisions to Type Certificate Data Sheets and Specifications will be published monthly. The original of each page revised, the first or title page, and the reverse side of each of these pages must be forwarded to AFS-513 for preparing negatives. Except when necessary to print all pages, do not send the entire data sheet. After the negatives have been made, the original will be returned to the issuing office. The Quality Standards Section, AFS-513, will prepare a page control chart for each monthly supplement advising of the pages removed and pages added by the revision. *

36. CHANGING SPECIFICATIONS TO DATA SHEETS.

a. When engine and propeller specifications are revised to add new models, the specification will be changed to a data sheet. Aircraft specifications may be changed to data sheets. However, the conversion is complicated because of the equipment lists involved and

should be made only if the type certificate holder provides an equipment list to be referenced in the data sheet or if the equipment listed on the specification is compatible with the data sheet concept.

b. In changing a specification to a data sheet, particular attention should be paid to the information required under "Certification Basis"; i.e., applicable regulations, date type certificate was issued, and date of application for type certificate. The date of application for a new model added to the data sheet need not be shown under the "Certification Basis" unless the regulations applicable to the new model are different from those under which the original model was approved.

37. AIRCRAFT TYPE CERTIFICATION DATA SHEET NOTES. When an applicant has developed advisory information for restricted category operation of an * aircraft certificated in restricted, dual restricted and normal, or transport categories, the information should be included in a note on the data sheet. Information should include restricted category weights, speeds, ranges, and altitudes at which the applicant has shown compliance with FAR 21.25. The need to develop additional operating restrictions * for individual restricted operations approvals under FAR 21.25 should be indicated in the Note. The Note should state that all parts of the normal or transport category airworthiness standards are not necessarily complied with at the weights noted for restricted category operation.

38.-40. RESERVED.

SECTION 3. SUPPLEMENTAL TYPE CERTIFICATES

41. SUPPLEMENTAL TYPE CERTIFICATES. This section pertains to the issuance of supplemental type certificates (STCs) by the FAA.

a. Supplemental type certificates will be issued for all major design changes to type certificated products when the change is not so extensive as to require a new type certificate. (See FAR 21.19.) They will not be issued to cover minor changes. Major changes are those so classified in FAR 21.93.

b. Supplemental type certificates will not be issued to approve replacement parts unless the installation of such parts constitutes a major change to the type design, or to approve modifications to technical standard order approved products.

42. PROCEDURE FOR ISSUANCE.

a. Initiation.

(1) A supplemental type certificate is applied for on an FAA Form * 8110-12, APPLICATION FOR TYPE CERTIFICATE, PRODUCTION CERTIFICATE, OR SUPPLEMENTAL TYPE CERTIFICATE (Form approved Budget Bureau * No. 04-R0078). In completing this application, the applicant should make reference in Block 6B to applicable drawings and reports.

(2) Upon receipt of an application for a supplemental type certificate, the regional Engineering and Manufacturing Branch will assign a project number, and to the maximum practicable extent * assign the project to the Aircraft Modification Staff/Section * which will function as the project coordinator.

* (3) Applications received by regional offices from applicants residing in other regions will be forwarded to the region in which the applicant resides for handling. *

b. Acceptance of Data.

(1) Major changes in a type design are to be approved only after receipt of descriptive and substantiating data for inclusion in the type design; therefore, all drawings or other data accepted must be adequate for reproduction of parts and/or installation of subsequent modifications. Photographs made from permanently marked negatives are acceptable, provided they or the report in which they are included contain all the information which would otherwise be found on engineering drawings.

NOTE: If the requested approval is only for one aircraft, the submitted drawings or other data need not be satisfactory for reproduction of parts and/or the installation and may consist of marked photographs, sketches, and word description.

(2) In case of approval for one aircraft only, a statement will be made on the FAA Form 8110-2 under "Limitations and Conditions" to read as follows:

Data pertaining to this modification are considered inadequate for duplication in other aircraft. This approval is limited to the installation made in (Make of aircraft)_____Model_____ Serial No._____, only.

43. DETERMINATION OF COMPLIANCE

a. Except as provided herein, the methods of determining compliance with applicable requirements are the same as those used for basic type certification. A supplemental type certificate will be issued only if the pertinent technical data have been examined and found satisfactory, all necessary tests and compliance inspections have been satisfactorily completed and the modification has been found to conform with the technical data.

b. Compliance Inspection.

(1) This function involves physical inspections of the prototype modification to determine compliance with FAR/CAR requirements which cannot be determined adequately from an evaluation of the technical data. These inspections will be conducted by an FAA representative.

(2) Compliance inspections may require flight tests when flight characteristics, performance and/or systems are affected. If subsequent installations on other aircraft of the same model * warrant flight test to show compliance, one of the following * notes shall be included on the STC under "Limitations and Conditions":

* "Subsequent installations on other aircraft of the same model shall require flight tests to show compliance with _____(insert FAR or CAR paragraph numbers as appropriate)," or

"Subsequent installations on other aircraft of the same model shall require flight tests in accordance with _____(insert document number, title, and date) *

to show compliance with _____(insert FAR or CAR paragraph numbers as appropriate)."

c. Compatibility Examination.

(1) If the modification under consideration depends on a previous modification for safety or performance, the necessity for having this feature should be made clear on the approved
* data. In addition, a new alteration should be compatible with related previous alterations to this aircraft to assure continued conformity with applicable airworthiness require- *
ments.

* (2) The controlling region should be consulted when a proposed major alteration is likely to affect critical characteristics of an aircraft. The controlling region, when consulted, should determine whether the proposed alteration could aggravate critical characteristics that are known to be marginal. Requests for advice should be limited to "need-to-know" inquiries. Requests for "nice-to-have" information should be avoided to preclude a region from being overburdened with such inquiries. *

44. CONFORMITY INSPECTIONS. This function is concerned with determining that the materials, parts, processes, heat treatment, fabrication, procedures, and installations, etc., involved in making the prototype modification do in fact conform with the approved technical data. Conformity Inspection Report, FAA Form 8100-1, will be used for reporting the results of conformity inspections. A Statement of Conformity, FAA Form 317 (Form Approved Budget Bureau No. 04-R0146) must be submitted to the FAA prior to the start of FAA tests. *

45. ISSUANCE OF EXPERIMENTAL CERTIFICATES. After application has been made for an STC and the modification has been carried out, if flight tests are necessary the applicant should obtain an experimental certificate in accordance with Subpart H of FAR 21 (see Handbook 8130.2), before he attempts to fly the modified aircraft.

46. ISSUANCE OF SUPPLEMENTAL TYPE CERTIFICATES.

a. When the applicant has submitted sufficient drawings, data, AFM material, when required, and reports, and his modified product is found to conform to such data and has passed required tests to substantiate compliance with the applicable regulations, he is entitled to be issued an STC. The information submitted must be approved, as adequate and correct, by the Engineering and Manufacturing Branch of the regional office. When the applicant employs a Designated Engineering Representative (DER), that portion of the data which the DER approves or recommends for approval, should be submitted with a FAA Form 8110-3.

b. When the agency determines that the modified design meets the applicable regulations, a supplemental type certificate (FAA Form 8110-2) will be issued by the regional office.

c. In preparing the STC, regional personnel should be careful to make clear under "Limitations and Conditions" exactly what products this STC may be applied to. If previous modifications are necessary to enable the newly modified product to be airworthy, this fact must be clearly indicated. If there is a possibility that the STC could be misused and applied to products for which substantiation has not been shown, it is recommended that a statement similar to the following be inserted under the heading "Limitations and Conditions", of FAA Form 8110-2, as well as on the approved data which is to be used by the installer.

> The approval of this change in type design applied basically to _____ only. This approval should not be extended to other aircraft of this model on which other previously approved modifications are incorporated unless it is determined by the installer that the interrelationship between this change and any of those other previously approved modifications will introduce no adverse effect upon the airworthiness of that

aircraft. This determination should include consideration of significant changes in weight distribution such as an increase in the fixed disposable weight in the fuselage.

d. The supplemental type certificate number will consist of the letter S, a letter symbol to identify the product, the serial number assigned by the region and the symbol of the region in which issued. For example: SA25WE would be the 25th STC issued by the Western Region, A is for an aircraft. SE5SO would be the 5th STC issued by the Southern Region, and E is for an engine. The symbols should be the same as used in type certification projects.

* e. If additional space is needed to describe either the type design change or limitations and conditions, continuation sheet(s) (FAA Form 8110-2-1) must be used for this purpose. The STC (FAA Form 8110-2) should make reference to the continuation sheet(s) by a note placed under the applicable paragraph; e.g., "(See continuation sheet(s) 2 through 4)." All continuation sheets should be numbered and should indicate the latest effective date, either date of issuance or last date amended, on STC. Continuation sheets will be available January 1970 (unit of issue, sheet) and can be obtained from the FAA Depot (Aeronautical Center) by referring to Federal Stock Number 0052-696-7000.*

47. RETURN TO SERVICE.

a. When all FAA individuals participating in the project have communicated to the project engineer that the modification complies with the regulations, the project engineer will recommend to the Chief, Engineering and Manufacturing Branch to issue the STC.

b. Where there is a need, the final approval notice and STC number may be transmitted by telephone and confirmed by a written communication over the signature of the Chief, Engineering and Manufacturing Branch to an authorized FAA representative to permit release of the product.

c. The actual STC form will be processed as soon as all written internal documents have been received by the project engineer and will be dated the same as the written communication which issued the STC.

d. When a modified product has been tested and approved by an issuance of an STC, the applicant must have an FAA Form 337, MAJOR REPAIR AND ALTERATION (Airframe, Powerplant, Propeller, or Appliance) (Form approved Budget Bureau No. 04-R060.1), prepared in duplicate in accordance with FAR 43, or another method approved by the FAA, to return the product to service.

48. DURATION.

a. A supplemental type certificate is effective until surrendered, revoked, or a termination date is otherwise established by the Administrator.

b. If a supplemental type certificate is surrendered, it should be marked "Canceled." The Chief, Flight Standards Technical Division, AC-200, should also be informed so that the canceled supplemental type certificate may be removed from the published list.

49. TRANSFER OF AND AMENDMENTS TO SUPPLEMENTAL TYPE CERTIFICATES.

a. When a regional office receives a supplemental type certificate which has been endorsed on the back by the owner for transfer that office should

(1) Issue a new certificate in the name of the new holder.

(2) Send all the data on this STC to the region in which the new holder is located.

(3) Send the new certificate to the new holder advising him to contact his region in the future regarding this STC.

(4) Notify the Chief, Flight Standards Technical Division, AC-200, of the transfer.

b. The original issue number should be retained. The date of original issuance and the reissue date should be shown. This is applicable only when the certificate itself is transferred and not when data are made available to others.

c. Supplemental type certificates may be amended to add new models, show revised data, etc. In such cases, the certificate should be reissued, retaining the original number and including both the original issuance and reissue dates. Supplemental type certificates should not be amended to add different modifications to the same type design.

50. ENGINEERING APPROVAL OF REPLACEMENT AND MODIFICATION PARTS. The procedure for indicating engineering approval of parts to be produced under a FAA Parts Manufacturer Approval will depend upon the nature of the product. Those parts, the installation of which constitutes a major change to the type design, will be approved by supplemental type certificates. Engineering approval of other parts will be shown by approval of design data only. Such data should be approved only when it is in the form of drawings, specifications, reports, etc., which are adequate for determining conformity and which may be easily identified. The engineering approval should also clearly indicate the type certificated product(s) on which the part is eligible for installation. A letter notifying the applicant of approval of his data should state the nature of the data; i.e., list reports, drawings, etc., and provide information as to how production approval may be obtained. (However, this should not be considered the approval basis.) The data or drawing list should be stamped or signed to show FAA engineering approval.

51. REGIONAL REPORT OF SUPPLEMENTAL TYPE CERTIFICATES AND APPROVED REPLACEMENT PARTS (RIS: FS 8110-6).

a. In order to make information on STCs which have been issued available to FAA personnel and the public, an index, Report of Supplemental Type Certificates Issued (RIS: FS 8110-2), of STCs will be published quarterly. Because of the large number of STCs issued, the descriptive information in the index must be kept to a minimum. Only STCs covering modifications for which the holder will make available design rights, data, parts, and/or kits to other parties will be included in the index.

b. Monthly, the regions will forward to the Aeronautical Center, AC-200, information for the index covering STCs and PMAs issued. Copies of the STCs will not be sent. The Regional Report of Supplemental Type Certificates and Approved Replacement Parts (RIS: FS 8110-6) information should include only the following:

(1) For STCs

(a) Make, model and original TC number of product.

(b) Name and address of STC holder.

(c) STC number and issuance date.

(d) A brief description of the modification, limited to one sentence, if possible.

(2) For PMAs

(a) Make, model and original TC number of product.

(b) Name and address of PMA holder.

(c) A brief description (one sentence, if possible), to include STC number when applicable.

c. The memorandum transmitting this material should have as its subject:

"Regional Report of Supplemental Type Certificates and Approved Replacement Parts (RIS: FS 8110-6)."

52.-54. RESERVED.

SECTION 4. MANUFACTURING INSPECTION RESPONSIBILITIES AND FUNCTIONS

55. MANUFACTURING INSPECTION RESPONSIBILITIES AND FUNCTIONS.

a. It is the primary responsibility of manufacturing inspectors to determine that prototype products (aircraft, engines, propellers, or components thereof) conform with drawings, specifications, and to evaluate all special processes. As a secondary responsibility, they are responsible for cooperating with the other engineering sections in the approval of certain design aspects which can best be evaluated by physical examination. The policies and procedures set forth herein are to be followed in carrying out these responsibilities.

b. Manufacturing inspectors should be alert for any detail design feature which does not appear to comply with the pertinent regulation. Particular attention should be given to fits, tolerances, clearance, interference, ventilation, drainage, and suitable provisions for inspection, servicing, and maintenance. However, the final design responsibility is vested in the appropriate engineering section. Accordingly, questionable design features will be referred through channels to such sections for final decision. Inspector responsibility is completed by these reports. Whenever the manufacturing section is requested to conduct special inspections, necessary instructions must be provided by the engineering section.

56. CONFORMITY DETERMINATION - GENERAL.

a. Conformity determination may be varied depending upon circumstances. A manufacturer's policies, quality control procedures, experience, inspection personnel, equipment, and facilities will dictate the extend of conformity inspection to be conducted or witnessed by manufacturing inspectors. Differences between manufacturers require that the conformity program be adjusted to fit existing conditions. In the case of an inexperienced manufacturer whose ability is unknown, it may be necessary to conduct a high percentage of conformity inspections until such time as the FAA inspector feels he can safely rely to a greater degree upon the company inspectors. He may then gradually reduce his own inspection or witnessing accordingly.

b. Manufacturers having previously demonstrated the acceptability of their quality control and inspection competence and who subject the prototype to these controls, should benefit by greater FAA confidence. In such cases, conformity determination may be made through a planned system of spot-checking critical parts and assemblies and by reviewing inspection records and materials review dispositions. By this method, advance consultation with quality control staff

personnel would specify the critical parts and assemblies to be held for FAA inspection.

c. Some manufacturers "route" experimental and prototype parts through inspection channels distinct from those handling normal production. In such cases, arrangements could be made whereby parts and inspection records are held until the manufacturing inspector visits these areas (or as otherwise agreed upon) and spot-checks or reinspects the parts (including the records) as he deems necessary.

d. If the inspector finds discrepancies, he may be justified in requesting a complete reinspection by the manufacturer. It is not intended that the inspector personally conduct a complete conformity inspection of each part he records on FAA Form 8100-1. He should, however, visually inspect and witness the manufacturer's inspection of the critical characteristics. Large assemblies or subassemblies may be inspected on a progressive basis to insure FAA inspection of critical areas prior to closing.

e. In a program of this type, increased confidence in the manufacturer, plus a planned program of spot-checking by manufacturing inspectors, should result in obtaining increased knowledge of conformity of the end product.

f. Regardless of the manufacturer's experience, it is the FAA inspector's responsibility to assure that a complete conformity inspection has been performed by the manufacturer, the results of this inspection are properly recorded and reported, and a Statement of Conformity, FAA Form 317 (Form Approved Budget Bureau No. 04-R0146) has been submitted to the FAA. In conducting conformity inspections, the following characteristics should receive primary consideration: *

(1) Materials.

(2) Are materials used in conformity with the drawings?

(3) What evidence is available to show that chemical and/or physical analysis has been conducted and is it satisfactory?

(4) Are hardness or other physical characteristics satisfactory?

g. Processes and Processing

(1) Is there a process specification for each special process?

(2) Has process specification been submitted for FAA approval?

(3) Does a check of the articles processed indicate that the process will produce consistent airworthy parts in production?

(4) Is the process being operated in accordance with the process specification?

h. Critical and Major Dimensions

(1) Has the manufacturer checked all critical and major dimensions?

(2) Does he have a record of these inspections?

(3) Does reinspection or surveillance indicate that the above inspections were accurate and adequate?

i. Workmanship

(1) Is workmanship of aircraft quality?

(2) Could the workmanship be duplicated under production conditions? (There is no regulation against the use of specialists, but if the satisfactory construction of the part requires unusual skills or training, notation of this should be a part of the TIR.)

j. Adequacy of Drawings and Related Change Records

(1) Can the part be built and inspected using the information on the drawing?

(2) Are drawing tolerances practical?

(3) Have all changes been picked up on the drawing submitted for approval?

(4) What procedure is used to insure the incorporation of an engineering change in the production part, and on the drawing?

(5) Did the drawing checked include all dimensions necessary to inspect the part, the material to be used, the treatment of the material such as hardness, finish, etc.?

(6) Have all unsatisfactory drawings been reported to the region, manufacturer, and on the FAA Forms 8100-1 and 8110-4 and -5?

k Adequacy of Inspection Records

(1) Are inspection records adequate to show all required inspections that are conducted?

(2) Do they show who conducted the inspection?

(3) Do they indicate the results of the inspection and disposition of unsatisfactory conditions?

(4) Are procedures adequate to insure reinspection of any parts that are reworked or replaced? (This includes inspection of installation of new parts as well as inspection of the parts.)

(5) Is the material review procedure satisfactory?

(6) Does it work?

(7) What disposition is made of rejected parts?

1. In cases where a design specifies parts of previously type certificated products and when such parts are taken from production stock, special precautions are necessary to determine whether such parts may have been subjected to materials review action. If so they should not be used unless it can be shown that such nonconforming parts will have no adverse effects or such parts are reinspected to determine and record all significant deviations for engineering evaluation.

57. PROCESSES.

a. Design regulations require fabrication methods that will produce consistently sound structure and that all methods requiring close control to attain this objective must be covered by approved process specifications. All such process specifications should be called out on the related drawings and thoroughly investigated by the manufacturing inspector in connection with the conformity inspection program.

b. In investigating and evaluating processes, the manufacturing inspector is primarily concerned with performance and conformity. Process performance must be capable of consistently producing articles that will meet the requirements as called for in the type design.

c. Process conformity is determined by an actual check of materials, tools, manufacturing and inspection operations being used to confirm they are as called for in the process specification. Conformity Inspection Report, FAA Form 8100-1, shall be used to report conformity check results.

d. Manufacturers should be encouraged, at preliminary type certification meetings, to develop and submit their process specifications for approval early in the program. They should also be reminded that the type certificate cannot be issued until all processes are approved.

e. Process specifications, called for in the type design data, should be submitted on a separate listing for approval by the appropriate engineering section.

f. The sole purpose of a process is to control a series of operations performed to insure consistent conformity and quality of the end articles in accordance with the type design requirements.

g. Since the usage of process specifications varies greatly in the industry, the manufacturing inspector should note those processes and areas within processes which will require surveillance during conformity checks. The processes and areas within processes which should be noted are those where the process controls are the only means of insuring that the quality of the articles produced is within the type design limits. Any deviations in these areas should be evaluated and approved before they are used in processing articles.

h. A process specification is generally issued to eliminate the repeating of the process on a number of drawings; however, the manufacturing inspector should be aware that where a process has singular usage, the process may be detailed on a drawing.

i. The evaluation of a process by the manufacturing inspector should be in three steps: First, the evaluation of the process description as called for on the engineering drawings or in the process specification; second, the check of the materials, tools, manufacturing and inspection operations of the process as called for on the drawing or in the process specification; and third, the inspection of the end articles to prove consistency with type design requirements.

j. After the manufacturing inspector has evaluated all three phases mentioned herein, he is then in a position to approve or reject the process submitted.

k. In the first phase where the basic information for the process is evaluated, it is important to see that the process information is presented in an orderly and complete manner. Otherwise, it may lead to misinterpretation and confusion, thereby causing the quality of the end articles to vary outside of the type design limits.

l. A common problem in this area is where a process specification, which had prior usage, loses its basic scope through amendments or changes made to make it usable on the product being type certificated. Therefore, it is important to see that the subject matter of the process specification is not cluttered with unrelated matter.

m. It is also important to make sure that the manufacturer's quality control and manufacturing departments concur that they can produce

articles to the type design requirements, using the process called for in the process specification or on the engineering drawings.

n. The data called out in any process should be in definite terms and not in general terms which are subject to various degrees of interpretation; such as, "adequate", "as necessary", "when required", "room temperature", "periodically", etc. Also, where tolerances are required to control the process, they should be clearly defined.

o. As a guide, the following outline can be used to check the content of a typical process specification:

(1) Scope
(2) Applicable documents
(3) Materials used in process
(4) Manufacturing
    (a) Manufacturing operation
    (b) Manufacturing controls
    (c) Test specimen (Construction)
    (d) Tooling qualification
    (e) Tooling control
(5) Inspection
    (a) Process inspection
    (b) Inspection records
    (c) Inspection tests
    (d) Inspection controls
    (e) Production inspection

p. If the above areas are covered by the process, where applicable, and are clearly defined, the actual operation of processing an article should be an effective one.

q. The second phase is checking that the articles being processed are in fact being processed in accordance with the process specification and that the material, tools, and equipment called for therein are being utilized. Since the end results depend on strict adherence to the process instructions, any deviation or discrepancy should be corrected on the initial runs.

r. The third phase, the inspection of the processed articles, is the main point of any process evaluation. In this phase, a determination must be made that the process operations are capable of consistently producing articles in conformity with the type design requirements. The method used in determining this fact should be the method as called for in the process specification; therefore, if this process is followed in producing production parts, all parts should be of equal quality.

s. Changes, amendments, etc., to the process should be carefully evaluated by the manufacturing inspector to determine what effect they will have on the consistency of quality of the end products before they are approved. In some cases, this may require a reinspection of the operations depending upon the extent of the changes.

58. STRUCTURAL TEST ARTICLES - AIRCRAFT.

a. Determining conformity of structural test articles is an essential phase of the type certification program. In conducting these inspections, the inspector must be alert to detect and report any nonconformities. All nonconformity conditions will be recorded in the normal manner.

b. Conformity inspections shall be conducted during fabrication and * assembly, and a Statement of Conformity, FAA Form 317 (Form Approved Budget Bureau No. 04-R0146) must be submitted to the FAA prior to testing. The final design submitted for FAA engineering approval must reflect all changes which have been found to be necessary as a result of the tests. This necessitates a satisfactory change record system to assure their incorporation in production drawings. Only in this manner will the FAA have any degree of assurance that subsequent production articles will conform with the test article. *

c. Due to the different effects of nonconformities on structural test articles versus flight articles, it is strongly recommended that parts and assemblies destined for official structural testing be clearly identified for that purpose. This should be necessary only in those cases where structural test articles are being fabricated concurrently with prototype flight articles. It is important that, once parts and assemblies have been subjected to structural testing beyond limit load testing, they be clearly and permanently identified to prevent their use in flight articles.

* 59. PROTOTYPE FLIGHT ARTICLES - AIRCRAFT. Determining conformity or flight articles, including checks of systems, should be made during fabrication. It is important that flight test articles conform to the data specified in the T.I.A. and the applicant's Statement of Conformity. This Statement of Conformity, FAA Form 317 (Form Approved Budget Bureau No. 04-R0146) must be submitted to the FAA before prototype flight articles are released for FAA test. Any nonconformities described under deviations shall be brought to the attention of the appropriate FAA engineering personnel for evaluation and decision as to their effect on safety and the validity of the tests under consideration. *

60. ENDURANCE TEST ARTICLES - ENGINES AND PROPELLERS.

a. As in the case of aircraft, determining the conformity status of test engines and propellers is likewise an important phase of the type certification program. Only parts subject to wear or change need be inspected for conformity by the manufacturing inspector prior to and after the endurance test. The condition of all surfaces subject to wear should be noted and the actual dimensions recorded. In addition, these and other critical parts should be serialized or otherwise positively identified for pretest and post-test comparison. A Statement of Conformity, FAA Form 317 (Form approved Budget Bureau No. 04-R-146) must be submitted prior to the start of FAA tests. *

b. At the conclusion of the endurance test and teardown inspection, conformity of the major and critical parts should be spot-checked by the manufacturing inspector who should give particular attention to the critical characteristics.

61. USE OF ENGINEERING DATA. Manufacturers should be encouraged to submit for conformity inspection purposes only those drawings that may readily be expanded into final production drawings. However, when a product is undergoing development, it is realized that this may not always be practicable and it may be necessary to inspect engineering layouts or even sketches. In such cases, the manufacturer should be advised that it will be necessary to conduct a complete conformity inspection on the first production article using not only the approved production drawings, but also the original sketches and layouts. As an alternative, if the manufacturer can show that he has a system whereby the original sketches and layouts are incorporated into the production drawings, then this double conformity inspection would not be required. Otherwise, the FAA has no assurance that products submitted for airworthiness certification or approval are like the test articles.

NOTE. Where Designated Engineering Representatives may be involved, it should be accepted practice to conduct conformity inspections utilizing DER approved drawings. A copy of the FAA Form 8110-3 submitted by the DER to FAA engineering, listing drawings approved by him, can be accepted as having engineering approval.

62. REPORTING, CONFORMITY INSPECTION RECORD - FAA FORM 8100-1 (RIS: FS 8100-1).

a. All conformity inspections conducted or witnessed by manufacturing inspectors are to be reported on the Conformity Inspection Record FAA Form 8100-1, and include all significant discrepancies and nonconformities. The original is to be forwarded to the Engineering and Manufacturing Branch concerned through the regional Manufacturing Inspection Section. The reports should be forwarded as soon as

completed for prompt evaluation and action on any unsatisfactory or nonconforming items. A copy of the report should be retained in the district office files for necessary future reference.

b. The engineering sections concerned should advise manufacturing inspectors whether nonconformities reported by them are considered acceptable or unacceptable.

63. GROUND INSPECTION - AIRCRAFT.

a. The basic purpose of the ground inspection is to physically determine that the aircraft submitted for FAA flight test meets the minimum requirements for quality, conforms with the technical data, and that it is safe for the flight phases intended. The results are recorded together with any other data requested. These functions should not be delegated to designees Designated Manufacturing Inspection Representatives (DMIRs) although their assistance under the direct personal supervision of the inspector is permissible.

b. The ground inspection is normally a progressive inspection performed in three phases, depending upon the complexity of the project, with the pertinent FAA Form 8110 being used as a guide.

(1) Phase I (preliminary ground inspection) - Includes all inspections of the prototype that can be performed satisfactorily during the course of development and construction. It applies primarily to complete type projects and to the more complicated "partials". Arrangements will be made with the manufacturer to promptly notify the manufacturing inspector whenever changes are made to components, systems, or installations previously cleared through FAA inspection. The inspector will then conduct such reinspection as he feels necessary. When this creates undue duplication of effort due to numerous development changes, he should defer reinspection to Phase II if practicable.

(2) Phase II (official ground inspection) - This is the final inspection of the complete prototype and should be performed just prior to FAA flight test. Detailed procedures for conducting inspections and tests for both phases should be worked out as far in advance as possible and coordinated with the manufacturer. This is important in order to preclude unnecessary delays and duplication of effort and to assure that all required inspections and tests are properly accomplished. Upon notification from the manufacturer that the aircraft is ready for inspection, FAA Form 317, a STATEMENT OF CONFORMITY (Form Approved Budget Bureau No. 04-R0146), should be obtained from the manufacturer. This is his notification and commitment that the aircraft is ready for FAA final inspection and flight test.

(a) In order to give the Flight Test Section sufficient time in which to prepare for the flight test program, the regional office should be notified in an expeditious manner that the ground inspection Phase II is being started.

(b) The aircraft should be placed in a secluded or segregated area where the inspectors can perform their work efficiently and unhampered. The manufacturer will prepare the aircraft for inspection at the discretion of the inspector and must provide all necessary assistance, equipment, and data essential to the purpose of the inspection. The manufacturer should perform no work on the aircraft without concurrence of the manufacturing inspector.

NOTE. FAA employees will not perform any mechanical work on the aircraft. A DER is not authorized to perform any mechanical work on the aircraft in the performance of his duties as a DER.

(c) The inspector performs the inspection using the Type Inspection Report, the pertinent FAA Form 8110, as a guide, the FAR/CAR as a basic reference, and follows the applicable TIA instructions. As unsatisfactory conditions are revealed, they should be referred to and discussed with the manufacturer's representatives concerned. All unresolved and controversial items are to be reported daily to the regional office. The Sections concerned will evaluate them prior to the Preflight Board Meeting with the manufacturer, and advise the inspector as to each decision before the Board meeting. The manufacturing inspector should exert every reasonable effort to expedite the ground inspection in order to reduce the time and cost to all concerned. The manufacturing inspector should witness all ground operable systems. He may operate them if thoroughly familiar with the particular systems, but only with the manufacturer's permission. Extreme caution must be exercised to avoid damage to any property. The manufacturing inspector should witness the weighing of the aircraft and verify scale accuracy. The equipment actually installed, including test equipment, should be verified so that changes occurring later during flight tests may be detected and flight loadings may be accurately computed. The weight and balance report, showing the actual empty weight and empty weight center of gravity together with the list of equipment installed, should be verified and a copy retained by the inspector.

NOTE. During this phase, it is not necessary to verify weights and moment arms of equipment items, but only to identify the equipment installed.

(d) After this phase and upon satisfactory accomplishment and inspection of any related rework or when completion of these can be reasonably predicted, the regional office should be so notified. At least a preliminary although perhaps incomplete draft of the Type Inspection Report must have been prepared by this time for review by the Preflight Board.

(3) Phase III (coordinated ground-flight inspection) - When the aircraft has been returned to flight status after completion of Phase II, it is the manufacturing inspector's responsibility to assure that the aircraft is airworthy and is ready for FAA flight testing. This includes a determination that all unsatisfactory items requiring correction prior to FAA flight are so corrected. In this phase, cooperation with the flight test specialist is emphasized.

(a) Instrumentation - Instruments, gages, recording devices, etc., which are used in official flight test must have been recently calibrated by a qualified agency and affidavits furnished. Affidavits should be spot checked and reconciled with the related equipment. In addition, it is the manufacturing inspector's responsibility to determine that the foregoing equipment is properly installed and safe for operation.

(b) Flight Loadings - The manufacturing inspector is responsible for determining that the various loading conditions specified by the flight test specialist are carried out by the manufacturer. This includes a determination that the ballast used is accurately weighed, located, and safely secured.

(c) Periodic Safety Checks - Throughout the FAA flight test program, the manufacturing inspector must determine that the aircraft is given adequate inspection in order to reveal any unsafe conditions that may develop and require their correction prior to further FAA flight participation. The frequency and extent of such checks should be at the discretion of the manufacturing inspector who should participate in them whenever practicable to determine compliance. The manufacturing inspector and flight test specialist should have a system devised of informing each other of daily changes to the airplane, and problems

encountered during flight tests. This is necessary so that the aircraft is tested for proper design and so that discrepancy items may be used in preparing the F and R program.

(d) Completion of Phase II Inspection - Almost invariably there will be inspection items left over from Phase II which could not be determined at that time, such as instrument markings, placards, unusable fuel, etc. These inspections should be completed during Phase III when opportunity arises. It is not necessary, however, that all markings and placards be incorporated in the prototype at this time provided they are adequately provided for in the Type Inspection Report.

64. COMPLETION OF TYPE INSPECTION REPORT. Type Inspection Report, FAA Form 8110-5 (RIS: FS 8110-8) for airplanes, 8110-4 (RIS: FS 8110-9) for * rotorcraft, 8110-8 (RIS: FS 8110-13) for balloons, or Supplemental Type Inspection Report, FAA Form 8110-26 (RIS: WS 8110-16) for STCs (when deemed appropriate) on aircraft, is to be completed at the conclusion of * the ground inspection. The report is to be submitted to the regional office in duplicate (original and one copy) in time for review by the Final Type Certification Board. One copy may be retained in the initiating office files.

a. The TIR provides a means of recording and reporting all significant unsatisfactory conditions found as a result of the inspectors activities during the type inspection. The Final Type Certification Board will make disposition of all unresolved unsatisfactory items and the inspector will be advised of the decisions reached by means of a copy of the Board report. To assist the Board in its evaluation, it is recommended that photographs of the unsatisfactory conditions be secured when practicable and submitted with the TIR.

b. When engines and propellers are involved the foregoing instructions as related to aircraft also apply, except that the TIR for engines is FAA Form 8110-6 (RIS: FS 8110-11), for propellers, FAA * Form 8110-7 (RIS: FS 8110-12), for STCs on engines or propellers use FAA Form 8110-26 (RIS: WS 8110-16), when deemed appropriate. The * TIR is to be completed as soon as possible upon conclusion of the endurance testing and teardown inspections. In addition, the conformity inspection reports, the results of the teardown inspection, and copies of memorandum pertaining to the inspections, should be made a part of the TIR.

65. TEARDOWN INSPECTION (ENGINES AND PROPELLERS)

a. Teardown inspection of engines and propellers after endurance testing is a specific requirement of FAR's 33 and 35, respectively, and should be witnessed by manufacturing inspectors. In this connection, the

manufacturer should be requested not to clean or disassemble the test article until the authorized manufacturing inspector is present, at which time the inspection should be conducted as follows:

(1) Step 1 - The inspector should carefully note the appearance of subassemblies during the teardown and before complete disassembly. He should specifically note any abnormal leakage in valves, seals, fittings, etc.; indications of excessive sludging or lack of lubrication; metal of foreign particles in the oil screens or passages; sticking or breakage of parts; lack of freedom of moving parts, and any other condition which may not be noticeable after complete disassembly and cleaning.

(2) Step 2 - All parts must be thoroughly cleaned and visually inspected for indications of galling, metallic pickup, corrosion, interference between moving parts, and cracks. Highly finished surfaces should be checked for condition and for discoloration due to excessive heat and lack of lubrication. Special attention should be given to bearings, gears and seals. Engine pistons, cylinder heads, turbine assemblies and other hot sections should be carefully inspected for indications of cracking or burning.

(3) Step 3 - Both ferrous and nonferrous stressed parts are to be inspected by a suitable nondestructive testing method such as magnetic particle inspection, X-ray, flourescent penetrant, ultrasonics, etc., for incipient failures.

(4) Step 4 - All parts subject to wear or distortion are to be dimensionally inspected to determine the extent of change during the test. This may be done by pretest and post-test dimensional comparisons. The results are to be suitably recorded.

(5) Step 5 - Upon completion of Steps (1) through (4), a teardown inspection report is to be submitted as required by the TIR (ref. 64.). This report will contain the results of the inspection, giving a comprehensive description of all defects, failures, wear and other unsatisfactory or questionable conditions including photographs of same. Since the Propulsion Section uses the report for engineering evaluation, its importance cannot be overemphasized. If the manufacturer elects to prepare such a report, it may be used for this purpose provided it is verified and signed (submitted copies only) by the manufacturing inspector.

b. In addition to the foregoing, all failed, defective, worn and questionable parts should be identified and retained by the manufacturer in safe storage for examination by Propulsion Section representatives.

66. WITNESSING OFFICIAL TESTS.

a. Official FAA tests, such as static, endurance, operational, pressure, etc., may be witnessed by manufacturing inspectors when so authorized and requested by the appropriate engineering section. Authorization may be included in the TIA or may be in the form of a memorandum. In all cases, however, adequate instructions from the engineering section concerned will be supplied together with a copy of the approved test schedule. When witnessing tests, manufacturing inspectors will determine that the instructions and test schedule are followed and will submit a memorandum report describing the test results. A copy of the manufacturer's test log or report should accompany the inspector's report and should bear the "witnessed" signature of the inspector. In no case should the inspector sign the manufacturer's reproducible master of such logs or reports.

b. Occasionally, manufacturers may request manufacturing inspectors to witness various tests prior to the receipt of an authorization. Before witnessing these tests, it must be made clear to the manufacturer that he assumes full responsibility, that the witnessing is unofficial and that it may be necessary to repeat the test if not acceptable to FAA engineering. All tests thus witnessed are to be reported. If the proposed test is of a major nature, the inspector should decline to participate until proper instructions and authorization are received.

67. ACCOUNTING FOR ENGINEERING CHANGES.

a. A procedure should be established with the manufacturer whereby the manufacturing inspector will be informed of all changes which are made to parts, assemblies or complete articles during the type certification program. This is especially important once such items have received FAA inspection clearance so that the inspector will have an opportunity to spot-check the changes as he deems necessary. When changes to previously inspected items are checked for conformity, * they should be reported on a revised Conformity Inspection Record, FAA Form 8100-1. When checked in connection with the ground * inspection, the results should be reported in the TIR if it is affected. For example, if the previously inspected TIR item was originally found to be unsatisfactory and the change renders it satisfactory, that fact should be reported. Conversely, if the previously inspected TIR item was originally found to be satisfactory and the change appears to make it unsatisfactory, that fact likewise should be reported together with a suitable explanation of the condition.

b. In addition to the foregoing, the manufacturing inspector should determine that satisfactory procedures are in effect for assuring that all changes required in the test and prototype articles are incorporated into production drawings.

68. AIRWORTHINESS CERTIFICATION OF PROTOTYPE.

a. When a potential type certification project becomes known, the manufacturing inspector should attempt to determine whether the applicant will eventually seek an airworthiness approval (or approval tag) for the physical prototype article. If so, the manufacturer should be urged to provide for FAA conformity inspection at the start of parts fabrication. He should also be cautioned that it will be necessary for the prototype to incorporate all changes found necessary as a result of the test program and the manufacturer must be able to substantiate complete conformity with the approved type design. If this is not done progressively, it may require extensive disassembly, modification and inspection prior to airworthiness approval.

b. Assuming that the foregoing has been accomplished, the mechanics of airworthiness certification of an aircraft will be handled in accordance with FAR 21 and Handbook FS P 8130.3. In addition, the manufacturing inspector must assure himself that the prototype satisfactorily incorporates all required changes. When applicable, he should also review the final type certification board report to determine that all outstanding items recorded therein have been corrected. Airworthiness approval of prototype engines and propellers should be handled in a similar manner except that the receipt of a current Statement of Conformity, FAA Form 317, will be construed as being equivalent to the application for airworthiness approval required for aircraft.

c. It frequently occurs that engines or propellers which are not yet type certificated are supplied for use on experimental aircraft. If such engines and propellers are not replaced with ones that are fully approved, it will be necessary for them to be modified to conform with their approved type designs and to be properly identified in accordance with FAR 45. Under these circumstances, the manufacturing inspector at the engine or propeller manufacturer's plant should be fully aware of the approval status of the engines or propellers originally supplied as well as the modifications necessary to bring them up to a fully approved status. If the work is to be performed at the aircraft manufacturer's plant, a list of of these modifications with copies to the regional offices concerned shall be furnished direct to the manufacturing inspector responsible for certificating the aircraft. The modification list will bear a statement signed by the manufacturing inspector at source certifying that when the engine (or propeller) as originally supplied has been modified in accordance with the engine (or propeller) manufacturer's instructions, and the work has been satisfactorily inspected by the manufacturing inspector at destination such engine (or propeller) will conform to the approved type design and be eligible for approval. In addition, any replacement or newly designed parts furnished to the

aircraft manufacturer must be accompanied by Airworthiness Approval Tags, FAA Form 186. The modification work itself should be performed under the personal supervision of a representative of the engine (or propeller) manufacturer.

69. FUNCTION AND RELIABILITY TESTING.

a. Function and reliability testing is the responsibility of all sections of the Engineering and Manufacturing Branch. Each Section has a responsibility in the determination of the airworthiness of the aircraft under test.

b. The manufacturing inspector is responsible for monitoring the functioning of all cabin installations, and the evaluation of maintenance and refueling at each stop. The manufacturing inspector will also conduct a check of critical parts and components so far as possible at each landing. He will assist in checking the weight and balance, and accuracy of loading schedule. Determine that the plane or accessories being tested conform to the approved data or drawings. Perform such other duties and inspections assigned by the Type Certification Board.

c. The manufacturing inspector will maintain a record of all demonstrations witnessed and all inspections conducted. All maintenance performed by the manufacturer's personnel will be reported.

d. Observation of emergency oxygen mask drops, pressurization, cabin heating, etc., will be coordinated with the flight test engineer when the results of these tests are needed for his report.

e. All information obtained during function and reliability testing will be reported on attachments to the pertinent FAA Form 8110, and a copy will be furnished to the flight test engineer for inclusion in his consolidated report of the test.

f. The FAA flight test pilot/specialist or his alternate is the senior inspector on all function and reliability flights. The manufacturing inspector will advise him of any special inspections or observations that are to be made.

70.-74. RESERVED.

CHAPTER 3. ENGINEERING EVALUATION OF DATA AND TESTS

SECTION 1 STRUCTURE

75. DIVISION OF FUNCTIONS AND RESPONSIBILITIES.

76. AIRFRAME AND EQUIPMENT.

a. General.

(1) Airframe and equipment engineers are responsible for approving the structural strength and detail design characteristics of the complete aircraft (with the exception of the propulsion system installation), the electrical and hydraulic systems (except components which are primarily for propulsion purposes), the heating, ventilating, and pressurization systems, but not the combustion or exhaust heaters. Other responsibilities are cabin compressors, including those driven by an engine power source, the fire protection and warning systems, protection of fuselage and cargo compartments, extinguishing agent toxicity, ventilating air contamination and structural strength of engine mounts and cowling.

(2) The airframe engineers will evaluate the process and the fabrication method utilized to produce a material or structure which is to meet the requirements of the FARs. This entails evaluation of process specifications to determine that the processes will result in the specified mechanical and physical properties and other characteristics used in design. For helicopters, the Airframe Section engineers are responsible for the main and tail rotors. This includes the evaluation of strength, fatigue and flutter of rotors, rotor hubs and controls. In certain instances, the flight strain program which is an integral part of the fatigue evaluation should be coordinated with the Flight Test Section.

(3) Typical problems in this area involve the determination of the abruptness of control inputs and the degree of blade stalling required. For vibration analysis purposes, it is necessary to consider the engine, with its accessories attached, as a part of the complete drive system in order to evaluate the effect of the engine vibration characteristics on other parts of the drive system, and conversely, the effect of other parts of the drive system on the engine vibrational characteristics. Similarly, it may be possible that a condition of undesirable vibration in rotors could be traceable to the drive system and vice versa. Therefore, close coordination between powerplant and airframe engineers with respect to the vibration characteristics of the rotors and drive systems is necessary to ensure proper evaluation.

b. Coordination. Instances arise wherein approval is desired of a major modification of a basic design of such a nature that flight tests must be conducted when the modified airplane is in one region and the technical data are in another. The investigation of the model is generally more easily handled in the region in which the airplane is located. In such instances the technical data will be processed in the region in which the data file is located. This situation obviously requires interregional coordination for such a project. In the issuance of the Type Inspection Authorization, the airframe project engineer should initiate the form and coordinate it with the other Sections actively engaged in the project. The TIA will be unsigned and should be forwarded to the other regions for completion and signature. The letter transmitting the TIA should make clear those items remaining to be accomplished by the applicant at the time of issuance of the TIA.

c. Maintenance Review Board Participation. A Maintenance Review Board is held for each new air carrier type airplane. The regional airframe and/or equipment project engineer will be called upon to advise in the establishment of inspection and overhaul procedures based on his knowledge of the manufacturer's fatigue strength life evaluation program.

77. ENGINEERING EVALUATION OF DATA AND TESTS.

a. Structure - General.

(1) The entire process of evaluation of a project requires close coordination and cooperation among all Sections in order that it may proceed smoothly, expeditiously, and with a minimum of disruption of the applicant's plans and program. It is essential that all personnel involved in a project maintain close liaison and assist each other by interchange of information which may come to their attention and is of concern to others.

(2) Only a relatively small number of engineers in the FAA are available to process the applicant's technical data to ascertain that his design complies with the FARs. It is obvious that complete detailed checking of data is not possible. Instead, an overriding check method should be used which is predicated on the premise that the applicant has completely checked all data presented for examination.

(3) When the applicant's data are calculated by digital or analog computers, some substantiation of such data should be provided to the FAA. Basically, it should be determined how the applicant's personnel satisfied themselves that the computer programs used were satisfactory for the particular problem. The substantiation of computer programs may generally be handled as follows:

(a) Supplying FAA with substantiating information accumulated by the applicant to check his programs.

(b) Submitting a manual calculation to check one point in the output of the computer program.

(c) For complex programs where it is considered impractical to furnish a manual calculation as a check, sufficient data and information should be furnished to assure FAA, to the extent possible, that the computer programs are correct.

(4) Where supplementary data can be provided, the computer program substantiation can be omitted. As an example, in the case of a flutter analysis using computer programming, the data obtained from a flight flutter test can be used as the basis for not requiring computer data substantiation.

b. Design Criteria Report. This report is used to describe the structural design of the airplane and should be the controlling document from which all subsequent loads reports are generated. The conditions presented should be further investigated in the loads reports in sufficient detail to permit ready determination of the critical conditions for all airframe components. Designations in all structural reports should be consistent with the designations in this report. Revisions to this report should be submitted as additional changes are made to the aircraft which effect structural design, design conditions and structural loads. Items to check for completeness of this report include: Sign convention to be used for load data; description of airplane; design weights; c.g. limits; design speeds; cabin pressurization (if provided); general requirements including loads, strength and proof of structure, and vibration and flutter; flight criteria; landing and ground handling criteria; control surface and system loads; miscellaneous loads, fatigue and fail-safe strength and load analysis procedures.

(1) Aerodynamic Data. Data obtained from low and high speed wind tunnel tests of scale models are generally acceptable and more appropriate than such National Aeronautics and Space Administration (NASA) data as may be presented in a form requiring considerable modification or correction in order to adapt it to the design.

(2) Supplementary Criteria. In some cases it may be necessary to incorporate into the Criteria Report pertinent criteria from military specifications to achieve military mission performance of the aircraft.

c. Basic Loads Data.

(1) This term is used to describe that portion of the applicant's data which determines the loadings for the various major airplane structural components in accordance with the design conditions specified in the regulations. In this regard, it is important that the approval basis be established by the Type Certification Board for the specific design being investigated. The applicable regulations and special conditions that apply should be defined before the basic loads are discussed. Basic loads data should receive priority over structural analysis data and efforts should be made to examine them without delay. These data form the basis of the structural investigation of the entire design and should be checked for completeness and accuracy.

(2) In evaluating basic loads data reports, emphasis should be placed upon the assumptions made and the methods by which the loads for each particular condition are obtained. Aircraft are becoming more and more complicated and more rational methods are being utilized in design load determination. Therefore, engineers responsible for reviewing basic loads reports should devote time and effort toward keeping current with the new concepts which must be considered in the design of modern aircraft so that evaluation of these new designs can be made on a sound engineering basis. The individual's work program should set aside sufficient time to permit reading the literature (i.e., NASA technical notes and reports, Wright Aeronautical Development Center (WADC) research papers, technical books, etc.) dealing with the design concepts and principles which affect the design of modern aircraft. For example, for the new high speed transport airplanes, the dynamic response to atmospheric turbulence is an important design condition which involves concepts of aeroelasticity and new methods of calculation. In this regard, the concepts of discrete gusts, power spectral density, and matrix notation should be studied and understood. In addition, engineers who have responsibility in the basic loads area should be encouraged to participate in formal college courses and other training activities which will keep them up to date in the basic loads area.

(3) For projects involving relatively new types of aircraft (e.g., high speed, high altitude, turbine-powered transports) and/or applicants who have limited experience in showing compliance with a particular part of the regulations, an external loads methods evaluation conference between regional engineers and the applicant should be scheduled (with Washington specialist participation, when requested) for the purpose of reviewing the methods by which the applicant plans to show compliance with the structural loads requirements of the

regulations. Such a meeting should be scheduled to take place as early in the project as practicable. In general, an external loads methods report submitted by the applicant, as well as FAA knowledge of problem areas in the particular part of the regulations and of the background of the particular applicant, should serve as the basis for formulating the agenda for this conference.

d. Weight and C.G. Data.

(1) The applicant's original aircraft weight estimate in general may be considered satisfactory without FAA check.

(2) It should be ascertained that a range of center of gravity positions is accounted for. In the case of airplanes with retractable landing gear, the center of gravity shift due to extension or retraction should be accounted for if it is appreciable. The effect upon center of gravity shift due to fuel movement (during fuel dumping, changes in flight attitude, etc.) and passenger movements should be considered.

e. Dimensions. It is good practice to check conformity of dimensions used in the basic data against actual dimensions shown on the reference drawings as the examination of the data progresses. In the early stages of a design, it often occurs that either the data or the drawings are revised without corresponding corrections to the other.

f. Gross Weight and Landing Gear Data. Gross weight and landing gear data are needed by Airports Service for runway strength planning requirements. Accordingly, applicants applying for a transport TC should be approached and advised of the need for the information listed below. The data should be submitted by memorandum to the Chief, Engineering and Manufacturing Division, Washington, D. C. as soon as it is available. Alternatively, the Division should be advised if no data can be obtained from the applicant.

(1) Gross weight (including anticipated growth)

(2) Gear geometry (plan view of contact with ramp, distances between tires, number of tires per truck, and distances between trucks)

(3) Tire pressures

(4) Footprint areas

78. DYNAMIC ANALYSIS.

a. Freedom from Flutter and other Aeroelastic Instabilities.

(1) General.

(a) The airframe project engineer with the assistance of the regional dynamics specialists must establish, prior to issuance of a TIA, that sufficient and proper substantiation has been supplied by the applicant to insure that the aircraft or rotorcraft is free from flutter and other aeroelastic instabilities.

(b) Each design must be carefully evaluated to insure all aspects of the subject are covered. The following areas are among those to be considered: Flutter of wings, control surfaces including tabs; whirl mode of a turboprop installation; control reversal of aileron, rudder and elevator; wing divergence; rotor blade flutter; rotorcraft ground resonance instability, and the fail-safe aspects of these various instability areas as required by the FAR. (Airframe and Equipment Engineering Report No. 45 contains definitions of various aeroelastic instabilities.)

(c) Additionally, the airframe project engineer should examine structural detail design aspects to insure that no unsafe aspects exist which could introduce aeroelastic instability in service. Among these aspects are the following: Adequate strength and design of control surface balance weights and continued rigidity and lack of excessive tendency in tab control mechanisms to develop free play.

(d) To provide timely, unhurried and complete coverage of this important structural area, the project engineer should discuss these substantiation needs with the applicant early in the type certification program to arrive at an early understanding and agreement on the scope of effort required, the amount of analysis or testing required, and the testing schedule. During the course of the type certification program, the airframe project engineer or dynamic specialist should monitor the flutter substantiation program by witnessing wind-tunnel test programs and by occasionally consulting with the responsible personnel on the progress of this effort. The highly specialized nature of the subject and the wide scope of factors affecting its resolution dictate that the cognizant regional personnel keep abreast of the progress and problems of the applicant.

b. Substantiation Procedures.

(1) General Aircraft.

(a) Past experience has indicated that many applicants in this class have limited knowledge and no regularly employed aeroelastic specialists to perform the substantiation effort. It is more important in this airplane class that early discussions and agreements be reached regarding plans for substantiation. Guidance from the region will be necessary to assist those applicants with limited knowledge. The project engineer, through the regional office, should be acquainted with source of DER flutter designees or other specialist personnel who can be recommended to the applicant when requested for such information.

(b) Simplified criteria which can resolve the aeroelastic problems are available in Airframe and Equipment Engineering Report 45 for the straightforward single engine aircraft described under FAR 23.629(c)(1) and (2). Where these simplified criteria do not apply, the airframe project engineer must establish with the applicant an acceptable substantiation procedure suited to the aircraft design. This must include agreement upon the methods of analyses, the number and kinds of cases to be considered, and the scheduling of the required ground vibration or flight test program.

(2) Transport Aircraft. The airframe project engineer must determine that sufficient flutter analysis and/or model testing has been performed to indicate that the design is free from aeroelastic instability over the operating range up to the margin as required by the FAR. Important aspects of the flutter substantiation which should be reviewed include the following: Analysis methods of sufficient scope to provide a correct evaluation; all weight and fuel loading distributions should be investigated; all elements which could affect the stability should be considered, i.e., effect of automatic flight systems, effect of Mach number, altitude, propeller forces and the effect of mismanaged fuel. Additionally, the aeroelastic stability substantiation should be reviewed to determine whether or not all fail-safe provisions of the FAR have been considered satisfactory.

(3) Rotorcraft. The flutter substantiation of rotorcraft blades is normally established in the accomplishment of a satisfactory flight strain survey program. This is true since such a program encompasses the envelope of design airspeed and rotor r.p.m., and sufficient aerodynamic excitation is presently

to excite any latent flutter modes. This is also true for other aerodynamic surfaces of the rotorcraft such as longitudinal trim controls. Where revisions to rotor blades or other aerodynamic surfaces are made subsequent to the flight strain survey program, the airframe project engineer should check to determine whether or not the revisions will influence the flutter stability of the affected surfaces to the extent that further flight testing may be necessary. For non-rigid rotors subject to "ground resonance" instability, the project engineer should review the design features incorporated to eliminate the occurence of this stability to determine that the detail design aspects of the feature would not lead to likely loss of the stabilizing effects in service. The rotorcraft design should be reviewed to determine that all fail-safe provisions of the applicable FAR related to aeroelastic instability have been satisfactorily accomplished.

(4) Ground Vibration Tests. The airframe project engineer or the dynamics specialist should witness the ground vibration test of the prototype airplane. In the case of general aircraft for which simplified flutter criteria of Airframe and Equipment Engineering Report (AEER) No. 45 will be applied, the resulting ground measured airplane frequencies will determine the degree of compliance with these criteria and the need for and magnitude of control surface balance. For designs in which flight flutter testing is to be the basis of flutter substantiation, the ground measured frequencies will provide the basis for determining the scope and flight configurations to be tested. For designs to be substantiated by flutter analysis, the ground measured frequencies will provide a measure of accuracy of the analysis or provide a basis for extending the analysis to fully cover the flutter substantiation. With respect to the latter, the ground measured frequencies should be compared with the applicant's analytically derived results. The calculated and measured frequencies should not deviate by more than 10 percent and the shape of the vibration mode analyzed and measured should be similar. Where larger deviations in frequency or lack of comparison in form exists, the analytical results and/or tests must be questioned and the differences resolved by further analysis or tests or satisfactory engineering explanation of these differences supplied.

79. TESTS.

a. General.

(1) Tests conducted by the applicant to substantiate the strength of the design or demonstrate the operation, function and reliability of a system should be witnessed by a representative of the Airframe and/or Systems Section. In certain instances, tests may be also witnessed and conformity inspections conducted by Quality Control Section personnel. The project

engineer should arrange to witness all major tests of new designs. The applicant should be requested to advise sufficiently in advance that a test is to be conducted in order that all necessary FAA personnel may arrange to be present.

(2) Flight structures which have been subjected to ultimate load testing are not to be subsequently used as a flight article. However, in cases where limit load is applied during static tests and the observed applied load exceeds the design limit load, the test specimen may be used on a flight article if no permanent set is recorded and if the structural examination which normally follows a limit load test reveals no damage to the structure.

(3) The witness to the test should examine the test setup with a view to determine whether suitable results are obtainable. Also, he should verify the accuracy of the test loads.

80. STRESS ANALYSIS.

a. Reports.

(1) This term is used to describe that portion of the applicant's data which determines that structural strength requirements have been fulfilled. The following guidance material is intended primarily for DER use in approving analytical data. The following procedures can also be used when evaluating reports on fail-safe structure, fatigue, windshield birdproofing, interior arrangements, etc. For convenience, such data are usually assembled in separate reports or volumes for the major components of the aircraft structure.

(2) Emphasis should be directed to examination of such reports to ascertain that: the methods and assumptions are applicable to the design; all loading conditions have been analyzed; accepted allowable stress values have been used; positive margins of safety have been obtained. In general, in the actual examination process, it is advisable to first scan the report noting the contents, general arrangement and presentation of data.

(3) Experience indicates that often a more thorough and rapid evaluation can be made on the more complicated or new structural configurations by conferring with the applicant to obtain a clearer understanding of the methods and assumptions utilized to show compliance with the strength criteria in the FARs. Such conferences preferably should be scheduled early in the type certification process. Detail checking of such reports by the FAA regional engineers for arithmetic errors, etc., is not necessary in those instances where the reports have received

prior approval by FAA DER Structural Engineering Representatives. Spot checks of data submittals are recommended only in the cases where DERs are not utilized by the applicant or where the DER involved has been found lacking in performance and is under close scrutiny for purposes of evaluation and possible termination. In general, in the actual data examination process there are many factors and items that should be evaluated from a technical standpoint.

(4) The following check items, and those listed in paragraphs 80b. through 80h., are typical only and are not intended to be all inclusive.

(a) Determine that values taken from the basic data reports are correct.

(b) Examine the basic assumptions.

(c) Note the methods of analysis employed.

(d) Check the use of factors of safety.

(e) Determine that allowable stress values have been properly substantiated and are used within established limitations. When design values are based on the results of specimen tests, determine whether they have been properly reduced to a "minimum guarantee" basis or "A" or "B" values in accord with Military Handbook 5 standards. In the case of stressed skin type construction, such as wing skin and stringer combinations, it should be ascertained that the same "effective width" is used in both the section property calculations of the wing and in the "allowable stress" calculations based on the results of specimen panel tests.

(f) It is desirable that parts of the reports which are relatively important and include extensive calculations (such as precise analysis, secondary bending, three-moment equations, and solutions of simultaneous equations), which are qualitatively similar to the type used for a previous model, be checked by comparing the results as a whole with previous data rather than by a routine detail check.

(g) In order to determine that the analysis is applicable to the design, items such as dimensions, materials, heat-treat values, pressure limits, etc., which are used in the analysis, should be checked by references to the drawing. If drawing number references are not included in the analysis data, it should be pointed out to the applicant, preferably in the early stages of the project, that the inclusion of such

information will expedite the handling of the project and will also provide him with useful references.

(h) A relatively short independent check of analysis by the examiner is desirable when this will be a "shortcut" in determining the applicability and accuracy of analysis data or if, in his opinion, such a move may forestall an undue delay in concluding the examination of the report.

(i) Manufacturers are making considerable use of computers in structural analysis. With the absence of comparable equipment, it is not possible to check in detail the manufacturer's results, and with our limited manpower it is generally not possible to check the programming of the computer. Emphasis should be placed on evaluating the basic equations, assumptions, and limiting conditions to insure that they are applicable to the program.

b. Wing Analysis.

(1) Check the spars and stressed skin for the critical load conditions.

(2) Check design of ribs and bulkheads where there is a change in direction of main structural members such as spars or stressed skin covering.

(3) Check effect of tip tanks due to following factors:

(a) End plate effect.

(b) Airloads on tip tank itself.

(c) Inertia loads of tip tanks.

(d) Wing flexibilities.

c. Control Surfaces.

(1) Check elevator and rudder spar design. The three-moment equation for a continuous beam should be used with care unless proper consideration of the deflection of supports (hinges) is included.

(2) Check use of proper bearing ultimate factors of safety.

(3) Check control horn design and installation.

(4) Note method and rigidity of attachment of tail surfaces to fuselage or hull.

(5) Note margins of safety at points where application of method of analysis used is questionable.

(6) Note proper use of maximum balancing load in design of stabilizer leading edge spar.

(7) When a strength test in lieu of a stress analysis is accepted, note that calculations to substantiate the hinge bearing installation and castings are also presented.

(8) Check hinge bracket attachments. A backup or reinforcing plate is desirable at such locations.

d. Control System.

(1) Check carefully to see that all castings used in the control system meet the casting factor requirement.

(2) Note that an additional multiplying factor of safety is not required in the design of cast fittings used in the control system.

(3) Check joints subject to angular motion for proper bearing multiplying factors of safety.

(4) When a strength test in lieu of a stress analysis is accepted, note that calculations to substantiate the bearing installations and castings are also presented.

(5) Allowable loads for bearings may be obtained from the pertinent catalogue file.

e. Landing Gear.

(1) When shock-strut technical data and pertinent correspondence have been sought out for reference in examining a project of current interest, a proper reference to the file location of these data and the pertinent correspondence should be incorporated in the airplane file.

f. Fuselages (Reserved).

g. Fittings.

(1) Make sure that correct load and proper multiplying factors of safety specified for various types of fittings have been used. Margins of safety shown in the analysis should include the proper multiplying factors of safety.

(2) Check method used for distribution of load between various portions of fittings, such as different plates, of the like or unlike material.

(3) Note if allowable stress used in computations is applicable to the proportions of the fitting considered (channel, angle, tube, etc.).

h. Cargo Pallets and Nets. Check to determine that the design loads are at least the minimum inertia forces specified in FAR 25.561. Critical flight and landing load factors should be accounted for, with particular attention given to vertical load factors. The effect of the cargo center of gravity position should also be taken into account. Check that the hold-down provisions and the floor also meet these requirements. The pallets and nets should be marked by a label of some sort to indicate the maximum allowable cargo load and maximum allowable lateral and vertical c.g. positions. Also, where pallets and nets are interchangeable from one airplane model to another, these same maximum values will not necessarily apply.

81. TEST PROPOSALS AND WITNESSING OF TESTS.

a. Submittal of proposed test programs, including structural load distribution data, should be scheduled early in the certification program. The test proposal should be checked to determine that the critical conditions selected to show compliance with the applicable regulations correspond to those listed in the basic data. **Also, the loads to be applied should be compared with the corresponding required loading as developed in the basic loads report or the structural analysis.**

b. As a general rule, all ground tests should be witnessed by the engineer assigned to the project unless this responsibility is delegated.

c. The engineer witnessing the tests should examine both the test proposal and the test setup with a view to determine whether **suitable results are obtainable. Any questionable items should be made known immediately to the representative of the applicant in charge of the test in order not to seriously disrupt the certification program.**

d. The expected service experience should be kept in mind during static testing. Such items as poor fatigue qualities, excessive deflection, and flimsy structures may be the cause of service difficulty even though the test specimen might qualify for type certification. Recommendations against such conditions should be brought into the record at the earliest practical time.

e. After returning to the office, the witnessing engineer should immediately write a trip report briefly describing the test, indicating the results obtained, and recording decisions reached and recommendations which may have been made to the applicant.

82.-86. RESERVED.

SECTION 2. DESIGN AND CONSTRUCTION

87. EQUIPMENT AND SYSTEM INSTALLATION STRENGTH QUALIFICATION. All systems, equipment, and appliance installations should be checked in the mockup and/or airplane for arrangement and proper support of components. Tests of major importance should be witnessed by the engineer or other designated FAA representatives.

88. MAJOR ASSEMBLY AND INSTALLATION DRAWINGS. Major assembly and installation drawings should be examined at an early stage in the project, or as soon as a file of drawings is available for any major component of the airplane. It is recognized that most drawings will receive DER approval. Notwithstanding, the following items should be noted for checking.

a. Reference to required material specifications.

b. Detail design practices of each major part, such as: radius of bend, fillets, fabrication methods, welding practice, tolerances specified, heat treatment, splices, castings, attachment locking means, stress concentrations, corrosion prevention means, and inspection provisions.

89. DETAIL DESIGN AIRFRAME. In checking the detail design features of major components, the following items should be noted:

a. Wings.

(1) Rib attachment to spars for rigidity and features susceptible to fatigue failure or secondary stresses.

(2) Flap and aileron hinge support brackets and their attachments for proper rigidity and structural continuity to avoid fatigue failures.

(3) Wing attachment fittings for features leading to stress concentration, fatigue failure, eccentricities, and continuity.

b. Control Surfaces.

(1) Static and dynamic balance provisions of aileron, rudder and elevators. Particular attention should be paid to the rigidity of balance weight bracket attachments.

(2) Rigidity of cantilever tail surface attachments.

(3) Rigidity of elevator, rudder, and aileron hinges. Note any features tending to load rivets in tension. In the case

of piano hinges, check ability of the local rib structure and hinge material to carry the eccentric loading caused by the hinge overhang.

(4) Rigidity of connecting structure between separate elevators.

(5) Check stops for adjustable stabilizer and trim tabs.

(6) Rigidity of flap surfaces interconnection.

c. Control Systems.

(1) Rigidity or strength characteristics not predictable by the stress analysis.

(2) Check system stops.

(3) Check trim tab control for irreversibility; also for ability to operate should primary system connecting element fail.

(4) If locks incorporated, check for compliance with regulations.

(5) Check for adequate cable guards or pulley brackets.

(6) Evaluation of the power portion of the control system (under both this Section and Section 3, para. 96b) should include consideration of the types of failures outlined in Review Case No. 61 and adhere to the principles therein.

d. Landing Gear.

(1) Check possible secondary stresses induced in landing gear or supporting structure due to deflection of the gear itself under load.

(2) Check retracting mechanism for any loads that may be applied to primary structure while gear is in intermediate positions between full-up and full-down.

(3) Check compliance with extended position lock requirements and manual operation requirements.

(4) Check heat treatment specified with respect to the member wall thickness.

e. Hulls and Floats. Check presence of watertight compartments to provide compliance with buoyancy requirements.

f. Fuselage and Cabins.

(1) Check baggage compartments for proper strength, placards, and suitable facilities to restrain baggage.

(2) Check number and size of exits, main and emergency control.
(3) Check materials and provisions for fire protection and control.

(4) Check windshield installation for compliance with strength, and in the case of transport category aircraft, bird impact strength requirements.

90. PROCESSES AND PROCESS SPECIFICATIONS.

a. The methods used in the fabrication of the structure are required by design regulations to produce a uniformly sound structure. The close control needed to meet this objective is accomplished by approved process specifications. Process specifications called for in the type design should be submitted for reference and approval during evaluation of the drawings by the appropriate engineering section. Process specifications can be considered approved when the manufacturer's drawing list is approved. When a special process such as metal bonding, lamination of plastics, or glass fibre, etc., is called out on a drawing, an engineering evaluation should be made of the special process. These processes receive engineering and inspection review and correction as necessary prior to approval of drawings on which they are called out. Manufacturers may provide a process specification index with their process book if there is sufficient quantity of processes.

b. In general, the process specification should cover the general objective or purpose of the process with its limitations, the precautionary measures or notes that apply, a detailed list of materials and/or equipment involved (reference to manufacturer's numbers is not considered adequate), the step by step procedures to perform the process, and inspection and/or test procedures that are applicable to demonstrate conformance, and any special handling, storage or protective measures that are pertinent.

91. MISCELLANEOUS.

a. Equipment List. The equipment list which is normally a part of the type design should include all items of required equipment under one heading and should list all items of additional equipment under appropriate headings. This list should be examined to determine that proper information is contained for the items shown. This should include the name and model of the item, the manufacturer's name, the weight and position from the airplane datum line, and method of approval.

b. Drawing List. Upon completion of the examination of the drawings and analytical data, the drawing list, when provided, should be checked to ascertain that the drawing file and list are complete and that list shows the drawing number, change letter, and title for the drawi

which have been approved. Discrepancies should be brought to the attention of the applicant or his representative and after the list has been corrected, the applicant's copy should be sealed and returned to him when the TC is issued.

92. - 95. RESERVED.

SECTION 3. SYSTEMS

96. AIRFRAME SYSTEMS.

a. General. Data submitted on airframe systems, including schematic diagrams, functional description, load and failure analyses and proposed test programs, should always be reveiwed to assure that the design concepts and principles, including provisions for reliability, are in compliance with applicable regulations.

b. When applicable, the review should ascertain that load and failure analyses have been based on laboratory mockup and aircraft test programs which simulate probable malfunctions and demonstrate functional capabilities as necessary for continued takeoff safe flight and landing. The necessary airplane flight tests should be discussed and evaluated with the applicant's appropriate engineering personnel for adequacy of the program. Program participation and determination of satisfactory results including TIR review should be accomplished.

97. ELECTRICAL AND ELECTRONIC SYSTEMS.

a. Under this heading is included the installation of all items of electrical and electronics equipment installed in the aircraft. Examination of data submitted in accordance with FAR will depend upon the method of approval of the particular items of equipment, whether by TSO or as an integral part of the aircraft.

b. The electrical load analysis, when required, should be examined primarily for method, basic assumption, and applicability. The examiner should not concentrate on checking arithmetical calculations except for spot checks. The primary responsibility for accuracy of computations may be assumed to rest with the applicant.

c. The installations of electrical and electronic equipment should be checked to determine that the equipment and its wiring are designed in such a manner that any reasonably probable malfunction will not create a hazard to the operation of the airplane. The installation of any equipment required by the regulations, as essential to the safe operation of the airplane, should be shown to perform its intended function. Some of the features which should be checked are that:

(1) The equipment is mounted in such a manner that it will not shift or become loose and foul control systems, etc.

(2) If the equipment is shock-mounted, there is sufficient space between equipment (with the shock-mount in the extended position) and control systems, etc.

(3) Proper provision is made for securing cables to avoid short circuiting and also to avoid cables fouling control systems parts, etc.

(4) If a transmitter is installed, the antenna lead-in and the cable from the transmitter to the lead-in present no fouling hazard.

(5) The strength of the mounting supports is adequate.

(6) The equipment installation should be such that proper ventilation and smoke control are provided.

98. HYDRAULIC SYSTEMS. Check the system diagram for general layout, function, pressure control, etc. See that check and relief valves, filters, and other auxiliary mechanisms are provided where needed. Check load analysis to determine adequate reserve energy supply. Check the detail design for suitable location of various items of equipment. Note that no lines or equipment are located in close proximity to electric equipment unless adequate protection is provided. Determine that lines, valves, and other components are adequately supported and that provision is made for line and fluid expansion. Note that flexible lines are used between all points having relative motion. Determine that fluid reservoir capacity is adequate for any type of operation and that sufficient pressures are available to all actuating cylinders to insure proper operation. Determine that the applicant has conducted endurance tests adequate for the purpose of simulating the repeated complete flights that could be expected to occur in service.

99. OXYGEN SYSTEMS. Check system diagram for general layout and functioning. Note cylinder and line pressures and method of regulation and distribution. Check that oxygen supply, flow, and outlets are adequate to meet the requirements for the type of operation. Determine that adequate pressure gauges, flow indicators, and controls are available to the pilot to control the distribution of the supply. Determine that the crew's supply is separated from that of the passengers, or that means are provided for insuring automatically that the minimum supply required for the use of the operating crew is reserved therefor. Check detail design to insure adequate support of lines, and suitable location of oxygen outlets, regulators, and other equipment. Check to see that oxygen lines are as far as practicable from and not in proximity to electrical wiring and equipment containing flammable fluids. Check that masks, dispensing means, and regulators are suitable for their intended function. If portable oxygen bottles are used to provide any

part of the required supply, check that they are securely stowed, are easily handled, and incorporate suitable means for indicating pressure and dispensing oxygen.

100. HEATING, VENTILATING, AND COOLING SYSTEMS.

a. Heating and ventilating systems should be checked for ventilating capacity and for possible contamination from carbon monoxide or other gases. The check should determine that the system does not impair the safety of the aircraft and/or its occupants. Functional examination should be the comparison of flight test data with design criteria.

b. The cooling system is, in most cases, an integral part of the pressurization installation and should be examined from the standpoint of its capacity to cool the ventilating air sufficiently to provide a suitable cabin temperature.

101. PRESSURIZATION SYSTEMS. A check should be made to insure that the ventilating and heating systems do not functionally impair the cabin pressurization. Ascertain that all pressurization system components required by the regulations are provided and function properly.

102. ICE PROTECTION SYSTEMS. In thermal systems determine that the heat sources have a capacity equal to the design demands of the system. Examine the design criteria used and determine the minimum heat requirements. The design criteria should compare favorably with the aircraft operational analysis criteria. In the case of pneumatic systems, determine that the air pressure required for proper functioning of the deicer is available and that positive means for deflation of the boot is provided.

103. FIRE PROTECTION SYSTEMS. Ascertain that all accessories and components comply with applicable regulations and TSO requirements (where applicable). Check suitability of equipment with respect to probable types of fires. (Class A, B, or C fires.) Check adequacy of detail installation design. Ascertain that all materials, structural and nonstructural, comply with the applicable flame-resistance requirements. Ascertain that cargo compartments are correctly classified. (Class A, B, C, D, or E.)

104. INSTRUMENTS AND INSTRUMENT PANELS. Check instruments to ascertain that the number of required instruments is installed in accordance with appropriate regulations. Check the instrument panel installation data to ascertain that the vibration data are in accord with those values recommended by the manufacturer of the instruments. This is applicable also to instrument components located elsewhere in the aircraft.

105. PITOT-STATIC PRESSURE SYSTEM.

a. The pitot-static system includes the installation of pitot heads and static ports connected by tubing to instruments for measuring and indicating dynamic and ambient air pressures. These pressures are used for determining airplane rate-of-climb, airspeed, altitude, and mach number. In addition, the pitot and static pressures may be used to serve other equipments such as mach trim, autopilot, air data sensor, and cabin pressure automatic controller.

b. Check the system schematic diagram for functional arrangement and (in FAR 25 airplanes) independence of the pilot's system, and provision to isolate and retain connection of the flight instruments of the copilot system. If the pitot tube utilizes a heating unit, check the continuity of the electrical wiring and the adequacy of the power sources.

106. TECHNICAL STANDARD ORDER EQUIPMENT ITEMS.

a. The installation of TSO items should be checked for compliance with the manufacturer's instructions and limitations and the pertinent airworthiness requirements.

b. The following is a list of typical items covered by this system with brief comments as to what should be noted in connection with their installation:

(1) Wheels, Tires, and Brakes. Ascertain that wheel load ratings are not less than the pertinent ground-load reactions, and that brake kinetic energy ratings are not less than that required for the airplane. Check to ascertain that a parking brake is provided.

(2) Seaplane Floats. Check to see that the "maximum airplane weight" float rating is not less than the airplane weight.

(3) Skis. Check to see that the static load rating of the ski is not less than the maximum takeoff weight of the airplane. Check the strength of the attachment and that the installation is in accordance with the ski manufacturer's recommendation, if any. Check the stabilizing device or check cables to insure that the skis will maintain the proper attitude during flight and landing and check its adequacy. Good design would dictate that the fittings for the shock cord and restraining cable be separately attached to the ski board, as instances have occurred wherein the cable fittings have pulled out from the board and have made the safety cable useless when both have had a common attachment. Safety cables should not permit a ski position which would prevent a safe landing.

(4) Safety Belts. Ascertain that the belt web installation minimizes wear due to its rubbing along the seat side edges or other structure while in use. The pertinent stress analysis or test reports of belt anchorages should be examined. If the anchorages are part of an approved seat, they will have been substantiated with the seat. Further, if the belt and fittings are not of the free swivel type they should be aligned so that the normal direction of pull on the belt is perpendicular to the fitting and the belt load is carried uniformly across the full width of the webbing.

107. EQUIPMENT ITEMS APPROVED AS PART OF A SYSTEM. Items in this group are those specifically designed for use on a particular type certificated aircraft. They may be an item for which there is no TSO, or they may be TSO items modified for a particular aircraft, or for use by a modifier, including the aircraft manufacturer. Examples of such items are batteries, generators, valves, switches, relays, pumps, outflow valves, turbocompressors, oxygen system components, etc. All such items must be evaluated as a part of the particular system to assure compliance with pertinent FAR requirements, including as appropriate: no hazard to aircraft resulting from malfunction of item, performing intended function, and no adverse effect on other systems.

108. MECHANICAL AND SAFETY COMPONENTS OR PROVISIONS.

a. Landing Gear. The kinetic energy absorption characteristics and structural strength should be checked for compliance with the approved landing gear technical data. The kinetic energy absorption drop tests of the landing gear should be adequately verified.

b. Landing Gear Retraction Mechanism. Check for method of up-locking and for positive means of down-locking. Check for emergency operation.

c. Brake Actuating Systems. Check for control and actuating forces or pressures. In the case of hydraulic brakes, check that the pressure available at the brake does not exceed that used in testing the brake. Check for strength of all connecting elements and for emergency requirements.

109. SYSTEM AND EQUIPMENT INSTALLATIONS. All systems, equipment, and appliance installations should be checked in the mockup and/or airplane for arrangement and proper support of components. Tests of major importance should be witnessed by the engineer or other designated FAA representatives.

110. WATER AND WASTE.

a. Check system provisions for capability of complete drainage.

b. Check system provisions for waste water disposal, so that if dumped overboard it would not impinge on any part of the aircraft.

111. INTERIOR ARRANGEMENT.

a. Check for assurance that seatbacks, in any position for required exits are in the upright position for excess exits, cannot interfere with the opening of any exit either from the inside or outside of the aircraft.

b. Check for assurance that passageways leading to Type I and Type II exits are unobstructed and that the minimum required width is maintained. Check for assurance that excess Type I and Type II exits are readily accessible. Seatbacks should be incapable of reclining into the passageway leading to Type I and Type II exits. Spring loaded, automatically retracting, cabin attendant seats located in passageways should not infringe in the required passageway when the seat is unoccupied.

c. Check for maintenance of access to Type III and Type IV exits. On aircraft with a seating capacity of 20 or more, check to assure that the outboard seatbacks do not interfere with the projected opening of the exits with the seatbacks in any position for required Type III and Type IV exits, and with the seatbacks in the upright position for excess exits.

d. Check for maintenance of the minimum required aisle width between seats throughout the cabin.

e. Check for assurance that injurious objects are not located where they can present a hazard to occupants.

f. Check for assurance that all required placards, markings, equipment, emergency lighting, and fire prevention considerations are installed and, where applicable operate at or above required minimums.

112.-115. RESERVED.

SECTION 4. POWERPLANT

116. GENERAL. The term "powerplant" embraces the complete propulsion system, including its ancillary systems, controls, and accessories. It also includes auxiliary power units, extension shaft drives, helicopter rotor power transmission systems, and powerplant fire protection systems. It does not include helicopter main and tail rotors and their controls. Due to the wide range and complexity of the components, systems, and accessories involved, it has been found advantageous from the standpoint of control and operational efficiency to divide the powerplant into four specialized areas, viz., engines, propellers, powerplant installation, and powerplant vibration.

117. ENGINE AIRWORTHINESS EVALUATION. The engine and its critical components should be designed and constructed to function reliably under all flight and atmospheric conditions when properly installed, operated, and maintained. The purpose of evaluating technical data is to verify that the engine does in fact comply with the Federal Aviation Regulations and will operate in an airworthy manner during the initially established service period between engine overhauls. The complexity of stresses in an operating engine precludes using stress analysis of parts as the basis for determining compliance with the FAR. Once the engine has been substantiated by endurance testing, however, some structural parts such as the mounting attachment accessories, pads, etc., may be evaluated on the basis of stress analysis and static tests.

118. EXAMINATION OF ENGINE TECHNICAL DATA. The propulsion engineer should ascertain that,

a. All drawings and specifications have been submitted together with a drawing (parts) list and that one has been checked against the other. He will then approve each page of the drawing (parts) list.

b. All specifications covering the fabrication, finish, heat treatment, etc., have been received and approved.

c. All test reports and computations required by the regulations, including those for reducing the horsepower or thrust delivered by the engine when operating in off-standard atmospheres at various altitudes, temperatures, pressures, ram conditions, etc., to the standard atmosphere values, have been received.

d. The test reports substantiate compliance with the regulations.

* e. All design features have been adequately tested and approved.

f. Installation and operation instructions that relate to design have been evaluated, and include at least the following:

(1) Installation design instructions with recommended installation practices.

(2) Operating design instructions including FAA approved operation limitations and approved methods for correcting performance data.

(3) Table of fits and clearances for use in assembly and checking.

(4) Approved fuels and oils.

(5) Design life limits.

g. Essential maintenance data has been extracted from the type design data for inclusion in the manufacturer's maintenance manual. This data, which is necessary to properly maintain the engine, should describe the details of any requirement which will be binding on an operator, including:

(1) All configuration adjustment limits,

(2) Adjustable part or component tolerances,

(3) Clearance or fit limits,

(4) Calibration limits,

(5) Component and system performance and function limits,

(6) System interaction and interrelationship requirements,

(7) Design life limits,

(8) Lubrication or other treatment requirements,

(9) Any other parameter or condition, and required redundancies and,

(10) Any new method, technique or practice essential to preserve the engine's compliance with the airworthiness requirements which are not within established methods, techniques and practices. *

* NOTE: Servicing and maintenance manuals required by section 33.5, including operation and installation data intended for the use of maintenance personnel will be reviewed and approved by maintenance type certification board members. In order to ensure the free exchange of knowledge and information of mutual benefit, regional maintenance and engineering personnel will work closely together in the administration of rules pertaining to these manuals. *

119. DATA REQUIRED. It is the responsibility of the applicant to submit engine descriptive technical data, test reports, and computations to demonstrate compliance with the requirements. The following are generally adequate to accomplish this:

a. FAA Form 312, Application for Type Certificate, Production Certificate, or Supplemental Type Certificate (Form Approved * Budget Bureau No. 04-R0078). This application, executed as * prescribed in FAR, Section 21.15, is submitted in duplicate to the FAA regional office of the Engineering and Manufacturing Division in the region in which the applicant is located.

b. Preliminary Technical Data. Technical data are to be submitted by the applicant as prescribed by FAR Section 21.31, to adequately describe the new engine model. These data include the following:

(1) A preliminary model description, specification, or equivalent, containing the information called for in Appendix A or B of Advisory Circular 33-2, Aircraft Engine Type Certification Handbook, as applicable and available to the applicant.

(2) Drawings showing external views and cross sections of selected components reflecting unique and typical detailed features.

(3) A review of significant development history emphasizing the extent of development experience with the engine, with particular emphasis on unique or complex features or their combinations not hitherto used in aircraft engines.

(4) Proposals for substantiating compliance with the requirements of FAR, Part 33, by means of technical analyses, where appropriate, or testing. These proposals should be submitted sufficiently in advance of the proposed starting dates of official tests and be in sufficient detail to enable a realistic appraisal of their adequacy before beginning the official tests.

c. Final Design Data. Upon completion of the prescribed tests and analyses to establish compliance with the airworthiness requirements, submission of acceptable data covering the following meets the data requirements of FAR, Section 21.21:

(1) Type Design Data

(a) Revised engine model descriptions as required to incorporate the effects of design revisions to be included in the approved type design. The model description is expected to be completed at this time by supplying data for the model description which is test verified and approved except where flight data are needed and are not available.

(b) Final drawings, material, and process specifications. Acceptable data will adequately represent the engine configuration which successfully complied with the required tests and inspections; the drawings and a drawing list will show the latest design change identification; drawings will be sufficiently detailed to identify and completely describe each part as to its dimensions, material, and finish requirements, and identify processes related to its manufacture.

(2) Type Certificate Data

(a) Reports and technical analyses intended to substantiate compliance with the required tests of the engine and components, and design criteria of the applicable requirements of FAR, Part 33.

(b) Instruction manuals, as prescribed in FAR, Section 33.5, are to be made available at the time of engine certification or as soon as possible thereafter. The type certificate may be issued even though such instructional manuals are not available; however, the type certificate data sheet will include an appropriate note precluding use of the engine in type certificated aircraft until all required manuals have been provided.

(c) An acceptable test report will include essentially the following:

1 Either a complete description, including photographs, of the test equipment utilized and the manner in which the engine was mounted and tested, or reference may be made to a previously submitted report which adequately describes the same equipment; a chronological description of the testing indicating the manner in which the tests are conducted; the calibration status of

instruments; report of all delays and their causes, including the stops made for minor corrections and any servicing to the engine; graphical plots showing variations in operating conditions during the endurance test; log sheets and calibration curves for the calibration test data; all data will be legible, accurate, and when plotted to scales easily interpolated; the method of correcting data to the operating conditions and substantiation of any correction factors used by the applicant for each general type of engine.

2 An acceptable teardown inspection report will describe test results by both dimensional tables of all major parts of the engine which incur wear or change of dimension as well as by photographs and descriptions; include discussion of any unusual wear, burning, overheating, part failure, impending failure, or the occurrence of heavy deposits on engine parts; will indicate the appearance of the engine parts before and after disassembly, but prior to being cleaned for detailed and dimensional inspection, where applicable; friction surfaces, such as air oil seals, compressor cases, valve faces, piston rings, and oil seals; will report the results of visual, X-ray, magnetic or fluorescent particle inspection, or other procedures as applicable, with respect to the major parts.

3 Laboratory analyses representing the types and grades of the fuel, lubricants, and hydraulic fluids used in the testing should be included in the report. The condition of the lubricant and hydraulic fluids after use in the engine should be covered. These materials should conform to either recognized industry specifications or other acceptable specifications.

120. COPIES OF TECHNICAL DATA TO BE SUBMITTED TO THE REGIONAL OFFICE.

a. Drawings - One set.

b. Drawing (Parts) List - Two copies, one to be approved and returned to the engine manufacturer.

c. Process Specifications - One set.

d. Test Reports - One set.

* e. Installation, operation, servicing and maintenance manuals. Eight sets, one for each domestic regional office, one for the maintenance segment in the controlling region, one for the Propulsion Branch, FS-140, and one for the Maintenance Analysis Center, AC-230. *

f. The applicant will issue service bulletins as needed after his engine gets into service. He should then submit six copies of data. These are modifications to the approved documents.

* 121. ENGINEERING APPROVAL OF ENGINE REPLACEMENT AND MODIFICATION PARTS. Engineering approval for a replacement part in a certificated engine should be made only when the applicant has presented evidence that the design of the part meets the airworthiness requirements of the FARs applicable to the product on which the part is to be installed. If the applicant does not show identicality with the approved type design, for parts other than those covered in Section 21.303(b), there can be no approval based on comparison of data. In such instances, no disclosure shall be made of the nonconformity nor of any aspect of the approved type design data. The applicant will be informed that his design data does not comply with the approved type design and that he may substantiate his design by tests and computations as provided in FAR, Section 21.303(c)(4), if he wishes to pursue his request for approval. *

122. PREPARATION OF TYPE INSPECTION AUTHORIZATION (FAA FORM 8110-1). In preparing this form, the propulsion engineer should fill out items 1, 2, 4, 13, 17, and 18 (square 3 and 4 from the top). The tests outlined in FAR, Part 33, should be listed together with any additional testing or instructions deemed necessary to comply with the provisions of Part 33.

123. AIRCRAFT ENGINE TYPE CERTIFICATION HANDBOOK, AC 33-2. This handbook describes acceptable procedures for the substantiation of engines for type certification and also contains additional instructions regarding the type certification process. Reference should be made to it by the propulsion engineer in evaluating engines for compliance with FAR 33.

* 124. ENGINE DESIGN CHANGES. Changes introduced into approved engines which affect airplane performance requirements, aircraft flight manuals, and engine installation details, should be fully coordinated and expedited by the affected FAA engine and aircraft controlling regions with the respective engine and aircraft manufacturers. The necessary steps should be taken to assure there is complete agreement among the affected regions concerning the requirements governing engine changes consistent with maintaining adequate airworthiness and safety standards. Aircraft Engine Type Certification Handbook, AC 33-2, contains additional information on this matter. *

125. PROPELLER AIRWORTHINESS EVALUATION. A propeller includes all parts, appurtenances and accessories thereof, Section 101(28) of the Federal Aviation Act of 1958; FAR Part 1, Section 1.1. This covers all accessories and associated equipment intended for use with the propeller, such as governors, spinners, brakes, synchronizers,

deicing slinger rings and deicing strips, blade cuffs and fairings, etc. The propeller is eligible for type certification if the applicant has shown that it meets the requirements of FAR 35 and has submitted satisfactory technical data covering the type design in compliance with these requirements.

126. EXAMINATION OF PROPELLER TECHNICAL DATA. The propulsion engineer should ascertain that:

a. All necessary data for the propeller have been received before any official tests are conducted.

b. Any design features or characteristics requiring special tests or special conditions are properly taken into account.

c. The proposed type test program which the applicant submits for approval includes all the tests and inspection required.

d. All questionable points pertaining to substantiation and testing of the propeller have been resolved with the applicant before the type inspection authorization is issued.

e. All design features have been adequately tested and approved.

f. Installation and operation instructions that relate to design have been evaluated, and include at least the following:

(1) Installation design instructions with recommended installation practices.

(2) Operating design instructions including FAA approved operation limitations and approved methods for correcting performance data.

(3) Table of fits and clearances for use in assembly and checking.

(4) Approved fuels and oils.

(5) Design life limits.

g. Essential maintenance data have been extracted from the type design data for inclusion in the manufacturer's maintenance manual. This data, which is necessary to properly maintain the aircraft, should describe the details of any requirement which will be binding on an operator, including:

(1) All configuration adjustment limits,

(2) Adjustable part or component tolerances,

(3) Clearance or fit limits,

(4) Calibration limits,

(5) Component and system performance and function limits,

(6) System interaction and interrelationship requirements,

(7) Design life limits,

(8) Lubrication or other treatment requirements,

(9) Any other parameter or condition, and required redundancies and,

(10) Any new method, technique or practice essential to preserve the aircraft's compliance with the airworthiness requirements which are not within established methods, techniques, and practices.

NOTE: Servicing and maintenance manuals required by section 35.3, including operation and installation data intended for the use of maintenance personnel will be reviewed and approved by maintenance type certification board members. In order to ensure the free exchange of knowledge and information of mutual benefit, regional maintenance and engineering personnel will work closely together in the administration of rules pertaining to these manuals.

127. DATA REQUIRED. It is the responsibility of the applicant to submit propeller descriptive technical data, test reports, and computations to demonstrate compliance with the requirements. The following data are generally adequate to accomplish this:

a. Application for Type Certificate, FAA Form 8110-12 (OMB 04-R0078). An applicant must submit this application for each new type of propeller and each major change described in FAR 21.19.

b. Preliminary Technical Data.

(1) A description of the design features, the proposed rating, and intended applications of the propeller (formerly submitted in discontinued FAA Form 335, Propeller Supplement to Application for Type Certificate).

(2) Drawings showing external views and cross sections of selected components reflecting unique and typical detailed features.

(3) A review of significant development history emphasizing the extent of development experience with the propeller, particularly with regard to unique or complex features.

(4) Proposals for substantiating compliance with the requirements of the FAR, Part 35, by testing or technical analyses where appropriate. These proposals should be submitted sufficiently in advance of the proposed starting dates of official tests and be in sufficient detail to enable a realistic appraisal of their adequacy before beginning the official tests.

c. Final Type Design and Certification Data. All data (formerly detailed in Civil Aeronautics Manual (CAM 14) which is to be submitted to the FAA to show compliance with the requirements will be set forth in an advisory circular which is currently in preparation.

128. RESERVED.

129. ADDITION OF BLADES TO AN APPROVED MODEL.

a. If the blades of one certificated propeller model are to be approved for another certificated propeller model, the data and tests approved for the original blades may be used for their substantiation in the modified propeller. Examination of the blade ratings for the two propeller models should indicate any necessary change to the rating of the modified propeller.

b. Approved blades from a two-way hub may be substantiated for a three-way hub, provided the blade retention system of the three-way hub has been substantiated. Since each blade in the two-way hub absorbed one-half of the rated horsepower, the applicant will usually request a 50 percent increase in the rating of the three-way propeller model. Requests for approval of propeller ratings substantiated in this manner may be granted.

130. TYPE INSPECTION AUTHORIZATION, FAA FORM 8110-1. The type inspection authorization (TIA) is the formal outline of the official tests and inspections a propeller must successfully undergo to establish eligibility for a type certificate. For propellers, only items 1, 2, 4, 14, and 18 need be completed. Under item 18, the "See Attached Pages for Instructions" block should be checked and a form similar to Appendix 2, Figure 3-1, should be used to specify the tests to be conducted.

131. FUNCTIONAL TESTS. The functional tests are intended to substantiate the blade actuating mechanism in the propeller. The tests need not be repeated when a similar design propeller of the same applicant has satisfactorily tested. This is particularly applicable when the propeller is to be type tested in conjunction with an engine type test. In the case of the original propeller, the control mechanism was cycled throughout the pitch range and was considered satisfactory when the propeller was subsequently certificated. In the case of a similar propeller, the control mechanism cycling may be confined to certain portions of the operating range, depending on the different power settings of the engine being tested.

132. TYPE CERTIFICATE DATA SHEET FOR PROPELLERS.

a. DATA SHEET FOR PROPELLERS WITH DETACHABLE BLADES.

(1) Heading - Numbering. The data sheet number will appear in the upper right-hand corner of the first page. This number will be the same as the type certificate number except that it will be followed by another number preceded by a dash, as for instance "P6EA-1." When the data sheet is revised, the suffix will be changed to the next higher number, as for instance "P6EA-2," and will denote the first revision of the data sheet. The name of the type certificate holder, in abbreviated form, will be included next and below that, the basic model designation or designations of the propeller as it or they appear on the pertinent type certificate. The issue date will complete this group. (Note. For a fixed-pitch propeller, the complete model designation appears on the TC. For a propeller with detachable blades, the basic hub model designation appears on the TC since it identifies the type design of the propeller.) The heading of each remaining page will show the data sheet number, including the suffix and the page number.

(2) Title. The title of the document will appear in the center of the page as "TYPE CERTIFICATE DATA SHEET NO. XXX."

(3) Preamble. The following paragraph will appear under the title:

"This data sheet, which is a part of Type Certificate No. XXX, prescribes conditions and limitations under which the product for which the type certificate was issued meets the airworthiness requirements of the Federal Aviation Regulations."

(4) Type Certificate Holder. The applicant's name and city (no street) address inserted opposite the words "Type Certificate Holder" should agree exactly with that shown on the application for type certification.

(5) Type. A brief description of the propeller should be inserted opposite the word "type" such as "ground adjustable," "manually controllable; mechanical," "two-position hydraulic," or "constant speed; electrical," whichever is pertinent. As will be explained, the pitch control is covered in Note 3 and feathering and reversing in Note 4. Reference, therefore, should be made to these notes when applicable as "(see Notes 3 and 4)."

(6) Engine Shaft. The type of engine mounting necessary for the propeller should be inserted opposite the words "engine shaft" as for instance "SAE No. 50, SAE No. 60, SAE No. 2 flange," etc.

(7) Hub Material. The basic material used for fabricating the hub should be inserted opposite the words "hub material." Most hubs have been made of steel but aluminum is now being used.

(8) Blade Material. The basic material used for fabricating the blades should be inserted opposite the words "blade material."

(9) Hubs Eligible. Suffixes may be added to the basic hub model designation to denote hub drillings and/or special design features. For instance, an "L" may designate one size bolt circle and a "K" another, or a "60" may be included to indicate that the propeller fits an SAE No. 60 shaft, and a "50" to indicate that it fits an SAE No. 50 shaft. Further additions may be made to the model designation such as "-1" to indicate nonfeathering and "-2" to indicate a feathering version of the same basic propeller model. Hub model designations incorporating such identifying suffixes should be inserted opposite "hubs eligible" and reference made to the appropriate notes appearing on the data sheet as discussed herein. It is not considered necessary to include a suffix such as "a" added to a "-2" suffix when the "a" denotes a minor change not affecting eligibility.

(10) Blades Eligible.

(a) The blades approved for use in the hub or hubs listed are shown on the data sheet in tabular form, as follows:

Blades Eligible (See NOTE 2)	Maximum Continuous HP	Maximum Continuous RPM	Takeoff HP	Takeoff RPM	Diameter Limits (See NOTE 2)	Hub and Blade Weight Max. Dia.	NOTE

(b) In cases where the blades listed have been approved at different ratings in more than one hub model, separate tabulations should be made under each pertinent hub model. The information that should be tabulated under each of the headings follows:

1 List the approved propeller blade in the column marked "blades eligible." The applicant usually requests approval of the propeller in a range of diameters. The model designation of the blade, therefore, which will result in a propeller of the largest diameter approved with that particular blade will be listed first. Below will be listed the model designation of the blade which will result in a propeller of the smallest diameter approved with that particular blade.

The preposition "to" will be inserted in between. The method used by the applicant to denote a reduction in diameter is explained in Note 2 below, and, therefore, this note is referenced by placing "(See Note 2)" below "Blades Eligible."

2 The maximum-continuous-horsepower and revolutions-per-minute ratings for which the propeller is approved will be listed under the appropriate headings.

3 The takeoff ratings will be likewise listed.

4 The diameter limits will represent the maximum and minimum propeller diameters as indicated by the corresponding blade model designations. An applicant may use the same blade model in several propeller models, but, in each case, the resulting propeller diameter should be checked since it cannot be assumed that the resulting propeller diameters are identical. This is because the blade socket of one hub may be further from the hub center line than the blade socket of another hub. The diameter limits are nominal limits as explained in Note 2, and, therefore, Note 2 will be referenced under the heading of "Diameter Limits" as "(See Note 2)." It should be noted that nominal propeller diameter limits are not included in an aircraft data sheet or specification. Instead, the appropriate manufacturing tolerance is added to the maximum permissible diameter and subtracted from the minimum permissible diameter.

5 The total weight of the propeller will be listed under the column headed "Hub and Blade Wt. (Max. Dia.)."

6 The number of any appropriate note, such as Note 5 or Note 6, will be shown in the column headed "Notes."

(11) Certification Basis. The following data shall be listed:

(a) CAR or FAR number and date (including latest amendment) at the time the application was submitted.

(b) Type certificate number and date issued.

(c) Date of application for type certificate.

(12) Production Basis. List the production certificate number.

(13) Notes. For conformity, the same numbering system and subject headings must be used for Notes on all propeller data sheets.

The Notes from 1 to 10 are explained therein. When one of a series of notes is not pertinent, "not applicable" will be inserted opposite the number of the note involved.

(a) NOTE 1. Hub Model Designation. Describe the hub model designation or propeller model designation, whichever is pertinent. Numerals or letters composing the hub or propeller model designation usually identify such features as basic design, number of blades, blade chank size, size fo engine flange or spline required for mounting the propeller. A series of suffixes may be used to denote minor changes not affecting eligibility and/or major design features such as feathering. The use of a diagram has been found suitable to indicate the significance of each numeral or letter appearing in the model designation. (Note: In some cases where the propeller is also used by military agencies, the propeller is identified by means of a suffix to the hub model designation. In such a case, Note 1 is entitled "Propeller Model Designation" and the appropriate suffix is explained. The propeller blade model must be added to this designation when included in the pertinent aircraft data sheet as, otherwise, a parts list would be needed to determine the blade model and propeller diameter involved.)

(b) NOTE 2. Blade Model Designation. As in the case of the hub model designation, a diagram has been found suitable to indicate the significance of any numerals or letters and to describe the system used to denote propeller diameter reductions. Below the diagram, a description will be included, when pertinent, to outline the system used by the applicant to identify telescoped blades or blades with square cutoffs. The following note will be included to explain "Diameter Limits" in the "Blades Eligible" table: "Diameter limits are nominal diameters of the assembled propeller and do not include the $\pm$ 1/8-inch manufacturing tolerance permissible for propellers with basic diameter less than 14 feet or $\pm$ 1/4-inch permissible for propellers with basic diameter 14 feet or larger.

(c) NOTE 3. Pitch Control. Describe the propeller pitch control substantiated by the applicant. The governors should be identified by name as well as model designation.

(d) NOTE 4. (1) Feathering.

(2) Reversing.

Identify any models that feather and/or reverse and indicate any special type of control that is approved.

(e) NOTE 5. Left-Hand Models. Indicate the approval status of the left-hand blade model of an approved right-hand blade model. When applicable, the digit 5 will be placed under "Notes" in the "Blade Eligible" table opposite the model designation of the approved left-hand blade. The following note is used rather than repeating the ratings, diameter limits, etc., for the left-hand model: "The left-hand version of an approved propeller model is eligible at the same rating and diameter limitations as listed for the right-hand model."

(f) NOTE 6. Interchangeable Blades. List interchangeable blades in groups. Such blades will have different model designations but will be otherwise similar as outlined in the following sample Note 6:

Only blades listed in the same group of the following listed groups are sufficiently similar aerodynamically and vibrationwise to permit interchangeability in the same diameter without a flight test. Group (a).

The note will be revised accordingly when blades are interchangeable in one direction only due to a change in alloy, surface treatment, or use of a blade vibration damper.

(g) NOTE 7. Accessories. Identify eligible accessories such as spinners, deicing and anti-icing equipment.

(h) NOTE 8. Shank Fairings. Indicate eligibility when a blade has been modified to incorporate shank fairings or cuffs. If the blade model includes shank fairings or cuffs when originally certificated, Note 8 is not required because the blade model designation will be sufficient identification in this respect.

(i) NOTE 9. Special Limits. Indicate (a) propeller-engine combinations approved vibrationwise for use on normal category single-engine tractor aircraft, or (b) approved installations of FAR 21.29 propellers.

1 A propeller model is eligible vibrationwise in any normal category single-engine tractor aircraft when it is installed on the same engine model used for the vibration approval of the particular propeller-engine combination. If the propeller vibration stress survey was conducted on a multi-engine or pusher aircraft, any placard found applicable in such a survey will be applied to the single-engine tractor installation

until a vibration resurvey shows that the placard is not required on the single-engine tractor application. Approvals of this type should be listed as follows:

Table of Propeller-Engine Combinations
Approved Vibrationwise for Use on Normal Category Single-Engine Tractor Aircraft

The maximum and minimum propeller diameters that can be used from a vibration standpoint are shown below. No reduction below the minimum diameter listed is permissible, since this figure includes the diameter reduction allowable for repair purposes.

Hub Model	Blade Model	Engine Model	Max. Dia. (Inches)	Min. Dia. (Inches)	Placards

2 Since the approval of most FAR 21.29, propellers includes the vibration and performance approval of the propeller for use on a particular engine-airplane combination, it has been found convenient to list these approval under Note 9 as follows:

Approved Installations

Propellers listed in this data sheet are approved only for use in the engine-aircraft combinations shown below:

Propeller Model	Aircraft Model	Engine Model	FAA Data Sheet Aircraft	FAA Data Sheet Engine

(j) NOTE 10. Special Notes. Use when a special note is applicable. For example, the type certificate may occasionally be granted before the applicant has completed the required service manual, Note 10 will be used in such an instance to indicate that the propeller is not eligible for installation until the manual becomes available. After approval of the manual, Note 10 will be deleted from the data sheet.

b. Data Sheet For Fixed-Pitch Propellers. Data sheets will be prepared for fixed-pitch metal and/or wood propellers except when expedient to include a fixed-pitch wood propeller model on an existing propeller data sheet. The format of the data sheets will be similar to those for propellers with detachable blades except as noted below.

(1) Type - Fixed-Pitch (Single-Piece).

(2) Engine Shaft - Omit.

(3) Material - Aluminum Alloy (or Laminated Wood).

(4) Number of Blades - Two.

(5) Hub Models Applicable - Omit.

(6) In lieu of the table of blades eligible, the following table of models eligible will be used:

Model (See NOTE 2)	Takeoff & Max.Cont. HP	Takeoff & Max.Cont. RPM	Diameter	Standard Pitch	Hub Drilling No. Holes	Hub Drilling Dia. Holes	Hub Drilling Dia. Bolt Circle	Diameter Pilot Hole	Hub Dimensions Dia.	Hub Dimensions Thickness	Weight (lb.) (Max.Dia.)

(7) Notes. The following notes will be used:

(a) NOTE 1. Installation. A typical note follows:

These models are for installation on flanged propeller shaft ends (See Note 2). The front plate supplied by the engine manufacturer is not to be used. Installation is to be made with special steel bolts which are either furnished or specified by the propeller manufacturer.

(b) NOTE 2. Model Designation. A diagram will be used to indicate the significance of the digits and letters in the propeller model designation. This diagram encompasses the data given in Notes 1 and 2 for detachable blade propellers.

(c) NOTES 3, 4, 5, 6, 7, and 8. Not applicable. (So marked on data sheet.)

(d) NOTE 9. Special Limits. In the table of propeller-engine combinations, the "hub model" and "blade model" columns are replaced by a "propeller model" column. The table applies only to fixed-pitch metal propellers.

133. PROPELLER SPINNERS

a. Spinners which are essential propeller accessories (i.e., necessary for the proper control and operation of the propeller) are required to be substantiated in conjunction with the propeller during its type certification in accordance with the provisions of FAR, Section 35.33. Spinners supplied by the propeller manufacturer, even though they may not be essential propeller accessories, are normally substantiated in conjunction with the propeller if it is convenient for him to do so.

b. Many airplane and parts manufacturers, however, design and manufacture spinners for use on personal type aircraft to improve the aerodynamic fairing of the propeller hub or promote engine cooling. Such spinners are nonessential propeller accessories, which are submitted for approval as part of the airplane under the provisions of FAR, Section 21.21 or 21.113, and must be evaluated to determine that, in compliance with FAR, Section 23.901(b), their design and installation are such as to insure safe operation. Investigation of failures of such spinners in service has frequently disclosed that insufficient attention had been given to providing enough sheet

metal thickness, adequate radii, proper fastening methods, or structural stiffness to satisfactorily withstand the vibratory, aerodynamic, centrifugal, and handling loads which the spinners encountered in service. As a consequence, cracking has occurred in the shell or bulkheads, or at blade cutouts and screw attachment holes, which resulted in some cases in separation of major portions of the spinner and pieces being thrown into and damaging other parts of the airplane. Vibration originating from the engine, propeller, and aircraft is perhaps the most common cause of spinner failures. The relatively thin sections employed in spinners are especially susceptive to fatigue failures unless particular care is used in the design and fabrication. To reduce the incidence of fatigue and other types of structural failures in service, the following factors should be considered when evaluating such spinner designs and installations:

(1) Adequacy of fillets and radii at section changes.

(2) Snugness of fit and security of attachment between the spinner shell and the flanges of bulkheads and backup plates. If these mating surfaces do not match very closely, the high and low spots will produce stress raisers which may induce fatigue failures.

(3) Adequacy of clearance provided by shell cutouts in spinners used with variable pitch propellers, over the blade angle range.

(4) Secureness and fatigue resistance of joints and fasteners used in the spinner assembly. Rivetted joints and screw fastenings are generally preferable to spot welding because they resist fatigue better. If spot welding is used, the adequacy of the welding process and the design of the weld itself should be checked.

(5) For long spinners, the adequacy of support provided forward of the propeller and the adequacy of attachment screw spacing with respect to proper load distribution.

(6) For spinners made of nonmetallic or composite material (such as fiberglas-reinforced plastics):

    (a) Adequacy of material strength, resistance to moisture penetration, and ability to withstand rain erosion.

    (b) Adequacy of bearing surfaces where attachment screws are located.

    (c) Availability of a specification describing the material and process. This specification could then be used to insure conformity of production articles with the original.

(7) Static balance of the assembled spinners with all parts attached. The rig used for the balancing and concentricity check should provide substantially the same centering and alignment for the spinner as would be obtained when the spinner is installed on the propeller. Dynamic balancing is not necessary.

(8) Operational adequacy which should be established during flight testing:

(a) Incident to type certification of the aircraft, when the spinner is installed on an aircraft undergoing type certification; or

(b) Required by FAR, Section 91.167, for aircraft being returned to service after alteration, when the spinner is installed on aircraft already type certificated; or

(c) Conducted to determine adequacy of engine cooling, when it is determined that the spinner installation might adversely affect engine cooling.

134-136. RESERVED.

137. POWERPLANT INSTALLATION AIRWORTHINESS EVALUATION. This area of responsibility covers all portions of the propulsion system installation which encompass those parts of the aircraft furnishing the motive power or which are associated with the starting, control protection, mounting, cooling, heating, fueling, lubrication, monitoring, and operation of propulsive elements. This includes, for example, the installation, control, and instrumentation of engines, propellers, power transmissions, auxiliary combustion units, auxiliary power units, cowling, firewalls, fuel systems, lubrication systems, induction systems, ice protection exhaust systems, cooling systems, and fire detection and extinguishing systems.

a. Powerplant Instruments. The propulsion engineers are basically responsible for propulsion system instrument installation and associated parts. Propulsion engineers will determine that propulsion system instrumentation conforms with requirements and that performance and acceptance in qualification standards are appropriate for each application.

b. Fire Protection. In the handling of aircraft fire protection, problems associated with powerplants, combustion heaters, and auxiliary powerplants are the responsibility of the propulsion engineer. Consideration of possible damage powerplant fires may cause to other airplane components and structure is of direct interest to the structural engineers. Where fuselage fire protection requires utilization of fire extinguishing equipment which is part of the engine protection system, the primary responsibility for the extinguisher lies with propulsion engineers, whereas protection of the fuselage and cargo compartments is the responsibility of the airframe

group. Similarly, protection against the possible hazards of fire and explosion resulting from lightning discharges in association with the propulsion system installation is the responsibility of the propulsion engineer.

c. Crash Fire Protection. This is also the responsibility of the propulsion engineer since the principal flammables are fuel and oil and the principal ignition sources are predominantly in the powerplant.

d. Engine Mounts. The effect of the engine mounts and flexible mounts on the vibration of the engine and propeller, their structural strength, and the cowling material on fire protection, accessibility, reliability, compartmentation, and cooling and ventilation of the engine and accessories are the responsibility of the propulsion engineer.

138. ENGINE INSTALLATION.

a. The operational and design limitations of a type certificated engine are listed in the FAA engine data sheet and in the engine manufacturer's FAA approved installation, operation, maintenance, and overhaul manuals. The limitations contained in these documents are to be observed.

b. The propulsion engineer should be thoroughly familiar with, and take into account, all of the engine limitations when evaluating the engine mounting structure and flexible mount units in collaboration with the structures engineers to ascertain the airworthiness of these components.

c. The continued airworthy operation of the engine is dependent on receiving continuous flow of fuel and oil with the limits specified on the engine data sheet and in the approved FAA instruction manuals. The propulsion engineer, therefore, must ascertain that the engine will receive the required fuel and oil within the specified pressure limits and that the specified temperatures for the engine, oil, and accessories will not be exceeded during any expected surface or flight operating conditions.

d. The engine design limitations include torque and overhang moment limits for each mounting pad provided to drive accessories needed for proper functioning of the various aircraft systems. The propulsion engineer should determine these limits are not exceeded and also that the accessories used have been substantiated for the particular use.

139. PROPELLER INSTALLATION

a. The operational and design limitations of a type certificated propeller are listed in the FAA propeller data sheet and the propeller manufacturer's FAA approved installation, operation, maintenance, and overhaul manuals. The limitations contained in these documents are to be observed.

b. The propulsion engineer should realize that the limitations on the propeller data sheet are those substantiated on the test stand, and, therefore, the limitations for the propeller installed in an airplane may be somewhat different because of severe vibratory stresses that may prevail at some particular flight condition. Except in the case of conventional fixed-pitch wood propellers, approval of the propeller installation may not be granted until a vibration stress survey is conducted in flight, or the vibration stresses are otherwise determined to be safe, and the results are approved by the controlling region for the propeller type design. The propulsion engineer should carry out the necessary coordination with all interested parties to assure that all airworthiness problems involving the propeller are satisfactorily resolved.

c. The propeller spinner is usually considered a propeller accessory because it is connected rigidly to the propeller. It affects the propeller balance and vibration, and, in turn is affected by the propeller vibration. The spinner is usually provided by the propeller manufacturer as an approved accessory. Where an applicant other than the propeller manufacturer desires approval of a spinner, the propulsion engineer should ascertain that the spinner is adequately substantiated to assure satisfactory airworthiness of the particular spinner design involved. (see paragraph 134.)

d. While the propeller manufacturer provides instructions for installing the propeller and its controls, it is the responsibility of the propulsion engineer to evaluate the installation of the propeller appurtenances and the propeller control systems in the airplane to ascertain that all the applicable airworthiness standards are met. This evaluation will include a check of detail design, functioning, and general airworthiness of the installation. Coordination with other sections having overlapping responsibilities should be accomplished where necessary.

140. REVERSING PROPELLERS. It is extremely important to assure that adequate provision is made to prevent inadvertent reversing in the air even when malfunctions occur. The fault analysis made of the entire reversing system must be reviewed to determine that it provided assurance that unwanted propeller reversing will not occur during flight, landing, and takeoff.

141. AUTOMATIC PROPELLER FEATHERING SYSTEMS. Automatic feathering may be incorporated in an airplane in order to improve one-engine-inoperative takeoff performance and, thus, to decrease required field lengths. It can be seen that, if the system malfunctions and automatically feathers when it is not intended to do so, it may be more of a hazard than a safety factor. It is essential, therefore, to thoroughly evaluate the reliability testing of the system (cycling and endurance tests) prior to approval of the design for purposes of establishing airplane performance. A substantial portion, if not all of such endurance testing, should be conducted on an actual installation in order to simulate closely the vibration, attitude, temperature, and other conditions that may be expected in actual service. The fault analysis should be examined to determine that unwanted automatic feathering will not occur.

142. FUEL, OIL, COOLING, ENGINE AIR INTAKE, AND EXHAUST SYSTEMS. The propulsion system installation includes the fuel, oil, cooling, engine air intake, and engine exhaust systems. In the case of each of these systems, the evaluation process is concerned with all elements of the system. The objective is to determine that the applicant, for type certification, has properly proven and substantiated by means of engineering analyses, tests, and demonstration that all applicable FARs and CARs are complied with in the design of each system. Since aircraft designers do not always have experience at their disposal which would enable them to establish compliance in their initial proposals, it is often necessary to constructively criticize system designs against a background of FAA engineering experience with previous projects and general knowledge of the behavior of similar systems on aircraft already in service. The evaluation engineer, however, must be particularly cautious and tactful in his comments to the designer concerning compliance in order that the FAA does not assume any part of the responsibility for showing compliance. The burden of proof for regulation compliance must be shouldered by the applicant. The following guidance information has been shown by experience as essential to carrying out proper system evaluation:

a. Know the Applicable Regulations in Detail. Prior to proceeding with the evaluation of a given propulsion system, the engineer should review and study applicable regulations and should know their meaning and intent. Preparation of an item-by-item checklist covering all essential regulatory points is helpful as a useful checking tool.

b. Know the Applicable Policies, Interpretations, and Procedures. The engineer should review the applicable agency material which provides policy, interpretations, and guidelines as well as correspondence relating to other similar projects so that he is familiar with the FAA positions with respect to the system he is evaluating.

c. Know the Proposed Installation. It is important to become familiar with a proposed installation in all its details by reference to the drawings submitted, discussions with the designers and test engineers

involved, and by physical examination and inspection of the systems in either mockup or actual full-scale representation. There is no substitute for a physical inspection in which proportions and relationships of parts, as well as various operational features, can be observed firsthand. Physical examination also offers an excellent opportunity for judging the question of accessibility, maintenance, inspection, and repair procedures.

d. Apply an Organized Evaluation Sequence. The engineer should carry out a step-by-step evaluation of the system involved, utilizing checklists or other equivalent means to assure that no omissions or oversights are made and to provide a basis for subsequent documentation.

e. Document Results. All evaluation procedures should involve careful documentation in the form of correspondence, technical reports, evaluation notes, and checklists. Adequate and well organized documentation is particularly valuable for subsequent reference in connection with supplemental type certification projects, modifications, repairs and alterations, investigation of service difficulties, and in the preparation of airworthiness directives.

143. EXHAUST HEATING SYSTEM. The general comments concerning methods and techniques of design evaluation are applicable; however, the following notes will be of additional assistance in the evaluation of exhaust heating systems:

a. Check suitability of heat sources.

b. Make general examination of ducts used for routing hot air, considering the system mainly from the standpoint of proper resistance to heat.

c. Examine the entire system from the standpoint of possible carbon monoxide contamination.

d. Examine hot air controlling system for reliability of operation.

e. Examine heating unit for proper cooling when not used for supplying hot air.

f. Examine entire system from the standpoint of fire hazards and ease of inspection and maintenance.

g. Determine that firewall cabin heat shutoff valves are of adequate design and provide a tight seal.

144. COWLING AND FIREWALL. The general comments concerning methods and techniques of design evaluation are applicable; however, the following notes will be of assistance in the evaluation of cowling and firewalls:

a. Check entire cowling arrangement, cooling air ducting, and baffling for good detail design practices and adequacy of baffle supports. The use of engine cylinder hold-down studs for baffle support introduces a possibility that the stud will be loaded eccentrically or that hold-down nut torque values will be gradually reduced in service. All instances of attachment of hold-down studs should be carefully evaluated, and, where doubt exists, comments should be solicited from the regional office having engineering cognizance for the engine.

b. Note provisions for support of all cowling ducting and whether flexibility is provided where needed.

c. Note that suitable materials are used and that fasteners and joints are of adequate types.

d. Consider the design and construction of special cowling sections from the standpoint of susceptibility to ground handling damage.

e. Examine firewall construction for proper type of material, suitable closure and fireproof grommets and fittings, and for methods or reinforcement if thin firewall materials are used. If firewall access doors are provided, determine that the door is so constructed that a fireproof seal will be maintained in service.

f. Check that proper fuselage or wing protection is provided aft of the firewall, if required.

45. POWERPLANT CONTROLS. The general comments concerning methods and techniques of design evaluation are applicable; however, the following notes will be of assistance in the evaluation of powerplant controls.

a. Check all powerplant control levers and handles for proper direction of motion and for proper and clear markings.

b. Determine that flexible controls are of approved types.

c. Examine all controls from the standpoint of possible creeping due to vibration or looseness which might be encountered in service.

d. Examine all powerplant control systems in detail from the cockpit lever to the actual component being operated, noting the rigidity of bellcrank and pulley supports, make, type, and model of control components used, and security of all fasteners.

e. In case of electrical controls, the design should be coordinated with the electrical group in determining that the system is arranged and installed in accordance with good electrical engineering practices.

Examples of such electrical systems might be complicated ignition control circuits, propeller speed, feathering and reversing control circuits.

f. Check the controls to determine that the markings can be seen readily during operation and are properly identified and marked to indicate clearly their method of operation.

g. Evaluate the location of the controls to determine that they are not likely to be confused inadvertently with any nearby control. In some cases, the need for isolated location can be eliminated by the use of appropriate guards or definitely distinctive design or method of operation of the control.

h. Evaluate the location of the controls to determine that they will not be inadvertently operated while other controls are being moved or while normal movements are being made in the airplane.

146. POWERPLANT INSTRUMENTS. The general comments concerning methods and techniques of design evaluation are applicable; however, the following notes may be of assistance in the evaluation of instrument installations:

a. All powerplant instruments should be checked for suitability of type and for completeness of instrumentation in accordance with requirements.

b. Installation of all powerplant instruments should be examined from the standpoint of proper marking, installation, adherence to instrument manufacturer's recommendations, etc.

c. It should be determined that all fluid lines meet the standards for fuel, oil, and coolant system lines and for fire resistant lines where applicable.

d. It should be determined that restricted orifices are provided where applicable.

147. FIRE PROTECTION.

a. A review of aircraft designs from the standpoint of preventing and extinguishing fires involves consideration of the design of all the foregoing systems and components from a somewhat different standpoint. The foremost objective to be kept in mind is fire prevention. This involves the same basic type of design analysis on both transport and nontransport types. However, protection of the aircraft after the occurrence of fire differs in marked degree between these two classes of aircraft due to the nature of the pertinent regulations.

b. Many aspects of detail design and arrangement relating to fire prevention cannot be adequately assessed from technical data and

drawings submitted for approval. It is, therefore, highly desirable to make personal examinations of new designs in various stages of completion in order to make a thorough review of the adequacy of the various features involved. An example of the design detail which can usually be evaluated best by actual inspection is the adequacy of the sealing of firewall, accessory section diaphragms, etc. Many other details will usually be found, the adequacy of which can also be considered most readily by examination of the actual airplane.

148. FIRE PREVENTION MEASURES. The basic principle of good fire protection is to arrange the various components and systems so that the contact of flammable materials with components which are potential sources of ignition will be unlikely. Since the failures of seemingly insignificant parts can result in fire, no components should be considered too unimportant to receive careful review from the standpoint of fire protection. Conversely, larger and more important components such as the exhaust manifold should receive the same careful attention and must not be overlooked simply because such components might receive more consideration from the manufacturer in their design and development. Items which should be given particular consideration in reviewing the fire protection aspects of powerplant installation design are:

a. The design of flammable fluid systems, with particular emphasis on the portions relating to

(1) Tank locations, detail design, and tests,

(2) Line locations and detail design of lines and fittings,

(3) Use of fire resistant flexible hose assemblies, and

(4) System accessories.

b. The design of accessory section diaphragms, if used.

c. The design and installation of exhaust systems.

d. Ventilation of nacelles, shrouds, muffs, and tank compartments.

e. Drainage of all areas where flammable fluids may be present as a result of leakage or failure.

f. Fire detection and fire extinguishing.

g. Arrangement in which there is a possibility of flammable fluid leaks, spray, or vapor reaching components which may cause ignition either during normal operation or as a result of malfunctioning of such components.

h. One of the most important considerations often overlooked in the design stage is ease of maintenance. A design that provides good

accessibility for inspections, repairs, and replacement of parts goes a long way toward the prevention of failures that may result in fire.

i. The detail design of exhaust components should be carefully reviewed from the standpoint of materials used, freedom from excessive vibration, stresses due to expansion and contraction, adequacy of support, proper cooling, and the like. Particular attention should be given to exhaust joints or sections which are covered by shrouds or muffs.

j. Fluid lines should be examined to determine that they are supported properly and provided with flexible connections when subject to vibration or relative motion between components to which they attach. Determine that hose connections are properly designed and not located so that they are forced to resist loads along the axis of the tubing due to the action of pressure within the line or due to relative motion. Fluid lines should not be routed above hot engine or exhaust parts. Fluid and exhaust system components should be located as far apart as possible so that, in the event of line failures, flammable fluids will not impinge upon parts which may cause ignition and so that, in the event of exhaust system failures, hot gases will not impinge on unprotected fluid lines or other components such as strainers, etc. If close proximity is unavoidable, fireproof shields should be used between the parts in question. Ventilation and drainage of the engine compartment should also receive careful attention.

149. FIRE EXTINGUISHING MEASURES. It is extremely important that the crew be made aware of the presence of a fire as soon as it occurs so that fire fighting procedures can be initiated while the fire is still small. This objective can be achieved by the strategic location of the powerplant fire detection system. One highly important aspect of fire extinguishing in the case of reciprocating engines is the provision to stop engine rotation by means of propeller feathering. For all installations, it is highly important to cut off the flow of flammable fluid feeding the fire, to protect the aircraft against spread of fire and destructive damage during the fire, and to extinguish the fire.

150. FIRE DETECTING SYSTEMS.

a. The crew must be made aware of the presence of a powerplant fire as soon as possible after it occurs so that emergency action can be initiated. This objective can be achieved by the strategic location of the detecting sensors of the fire detection system which may consist of unit detections, continuous loops of detector element, optical "eyes," or other means for sensing excessive temperatures, rapidly rising temperatures, or the luminosity of a flame.

b. A complete fire detection system consists of the sensor, the control box, the warning device (light, bell, or horn), wiring, and such other

equipment as may be associated with a particular type of system. The system must incorporate a testing device, but this device has no requirement beyond that of determining the continuity of the electrical circuit.

c. The procedure for approving a detector system involves the following determinations:

(1) That the equipment has either been TSO'd or has been found to comply with the performance standards of the applicable TSO; that it is a type suitable for the intended use, and that the established limitations can be observed in the installation.

(2) That the fire detecting sensors are properly located, spaced, and adjusted to readily detect any excessive heat condition or flame originating in the protected zones. Hydrocarbon fires can be most readily detected as they emerge from cowl openings in zones of relatively high air flow. Such fires, otherwise, tend to gravitate to the lower portions of a zone. Other types of fires (and overheat conditions) may occur at any of a number of points, thus necessitating rather extensive detector coverage to assure rapid detection in all cases.

(3) That the sensors are supported and otherwise installed in accordance with the manufacturer's recommendation.

(4) That the associated electrical circuit is properly designed and installed and that precautions are taken against short circuiting due to damage in service or the entrance of moisture at connections in the electrical system; that fire-resistant wiring is used in fire zones and is properly supported throughout.

151. FIRE EXTINGUISHING SYSTEMS. Fire extinguishing systems are required on all transport category airplanes and certain transport category rotorcraft to protect all designated fire zones as defined in the regulations. Such systems are not required on other types of airplanes or rotorcrafts but, if installed, must be adequate for the purpose; one shot being considered sufficient in such cases. The procedure for approving a fire extinguishing system involves the following determinations:

a. That the system is fabricated of proper materials, as described in the regulations.

b. That each shot provides the proper amount of agent at the proper rate of discharge and for sufficient duration to create an inert atmosphere at all points within each protected fire zone simultaneously. The adequacy of the discharge can best be determined by use of the apparatus known as the extinguishing agent concentration recorder. This apparatus can be used in flight tests, preferably, or in

ground tests where flight conditions are simulated. The apparatus and associated services may be obtained from a private firm specializing in evaluations of this type.

c. That the agent container is located where it will not be subjected, under airplane operating conditions, to such extremes of temperature as to adversely affect its operation.

d. That the agent itself is satisfactory. Other acceptable agents in addition to methyl bromide and carbon dioxide are: Bromotrifluoromethane, dibromodifluoromethane, and bromochloromethane.

152. WITNESSING TESTS. As a general rule, all ground tests of the propulsion system should be witnessed by the propulsion engineer assigned to the project unless this responsibility is delegated to Manufacturing Inspection Branch personnel. The person witnessing the tests should examine the test setup with a view to determining whether suitable results are obtainable. Any questionable items noted should be made known immediately to the representative of the applicant in charge of the tests. After returning to the office, the witnessing person should immediately write a report briefly describing the test, indicating the results obtained, and recording decisions reached and recommendations which may have been made to the applicant.

153.-156. RESERVED.

157. POWERPLANT VIBRATION EVALUATION.

a. Powerplant Component Vibration. There are two different basic methods used in the vibration substantiation of powerplant components: One is associated with reciprocating engines and drive systems where endurance testing of a complete unit is performed to accumulate a sufficient number of cycles to show that all components will withstand a predetermined fatigue limit, and the other concerns fatigue testing of individual components under appropriate conditions to define their life limitations. The controlling difference in deciding which method to employ is generally where in-service wear or foreign object damage is likely to produce stress concentrations which greatly lower the fatigue life of a part, and any amount of endurance testing would not compensate for such a factor.

(1) Separate fatigue testing of components under simulated service conditions is generally better than endurance tests in that more specimens can be tested, which better evaluates the scatter found in the fatigue strength of a design. Such a procedure also allows components to be tested at higher than normal loading conditions to determine the factor of safety that might be present for a given design and also to determine the likely point of failure in service so that design improvements can be made in the most effective areas.

(2) Endurance testing of complete powerplant components is only permitted where the design and/or exciting forces are too complex to conduct fatigue testing otherwise. When endurance testing is used to determine the adequacy of a design from a fatigue standpoint, the maximum loading conditions must be assured in establishing a test schedule.

b. Complete Power Plant Vibration. There are certain types of powerplant vibration that must include the complete system, and other types that can be handled where the predominating vibration is essentially within one component. In all cases, it must be realized that the total system is involved in any mode of vibration even though the predominance may not appear to involve the complete propulsion system.

(1) Experience indicates that, generally, when the evaluation of fatigue strength of any component is required, a mode of vibration of the system is involved. It is possible, however, that nonresonant or cyclic loading can result in situations where the fatigue strength must be taken into account.

(2) When the excitation is produced totally within the propulsion system, testing can be accomplished on the system mounted on

a test rig and accomplished on the ground. Where aerodynamic excitation is involved or a combination of circumstances exist that do not permit the proper excitation to occur during ground operation, then the system must be tested either under flight conditions or by simulating flight conditions.

(3) Some of the fatigue and vibration problems that should be considered in any new design or where service difficulties are encountered are discussed below under the heading of the major propulsion component involved. No attempt to cover the detailed method for evaluating these from a vibration and fatigue standpoint is made; rather, they are presented from a more objective standpoint.

8. PROPELLER VIBRATION. Propellers are generally divided into two major classes as far as vibration and fatigue substantiation is concerned. The primary difference involves the type of aerodynamic excitation the blades receive in service. If the blade receives a form of excitation that involves the fundamental blade mode of vibration, fatigue limits for at least three portions of the blade are obtained, i.e., blade tip, mid-blade, and shank retention area. Where the fundamental blade mode is not involved, then the fatigue limits for only the blade tip and shank retention area are necessary. Experience has shown that the first group involves propellers over about ten feet in diameter, and the second group involves propellers under ten feet in diameter. With the advent of smaller propellers for turbine engine installations, smaller diameter propellers may fall in the first group where fatigue limits for three areas of the blade are obtained.

a. Since propeller blades are subject to foreign object damage in the blade tip area and galling in the retention region, component fatigue testing is required rather than endurance testing. Representative damage must be present in the blade before fatigue limits are established since the stress concentrations due to the damage control the fatigue limits to be established.

b. If the only significant excitation to the propeller comes from the engine and not from aerodynamic forces, it is possible to substantiate the propeller vibration as an engine-propeller combination. This is generally true for normal category single engine tractor type aircraft. Based on this concept, it has been found acceptable to approve propellers vibrationwise on specific engine models or groups of engines where the crankshaft dynamic characteristics and engine power conditions are comparable. On these combinations, it is desirable to conduct the propeller vibration surveys in flight rather than on the ground due to some shift in blade angles which results in some change in blade stresses.

c. For propeller installations where aerodynamic excitation is a factor, all propeller substantiation must be based on full flight testing to

include all conditions that the propeller will be subjected to on the aircraft. In addition to aerodynamic excitation the propeller receives in flight, it is necessary to expose the propeller installation to crosswind condition while operating on the ground. Crosswind excitation can be such as to produce excessive blade stresses if the r.p.m., wind direction, and wind velocity are of the right order. Aircraft that require flight testing to evaluate propeller vibration are multiengine, pusher and single engine tractor utility and acrobatic category aircraft, and unconventional designs where aerodynamic excitation is present.

d. The only propeller type that does not require vibration substantiation is the fixed-pitch wood propeller. For propellers having wood or plastic blades but metal retention components, only the metal components in the retention area must be substantiated from a fatigue standpoint.

e. The state-of-the-art of measuring propeller blade stresses has been limited to only vibratory stresses and combining these values with stresses as calculated. Recent developments have shown it possible to accurately measure all stresses and not have to rely upon calculations to determine the stress range that exists in the propeller under all conditions of operation.

159. ENGINE VIBRATION. The subject of engine vibration and fatigue substantiation is subdivided into reciprocating and turbine engines due to the basic vibration problems of the two types being so different.

a. Reciprocating Engines. The only major vibration problems that have proven detrimental to safety in reciprocating engines are crankshaft torsion and crankshaft bending. Crankshaft torsion, generally, is associated with natural resonant vibration modes of the system, whereas crankshaft bending can be either the resonant or nonresonant (forced) vibration type.

(1) Crankshaft torsional vibration is the result of a phenomenon of one or more natural modes of the crankshaft system excited by orders of the gas and inertia forces reacting within the normal operating speed (r.p.m.) range of the engine. There is generally only one mode of the crankshaft system that is significant from a torsional standpoint and it may appear several times in the operating range of the engine excited by different orders of vibration. The fundamental or first mode of the crankshaft system in torsion associates the supercharger drive and impeller but is not considered a critical safety factor in most systems. In single row, dual row, or four and six cylinder in line engines the second mode of the system or the fundamental mode of the basic crankshaft becomes the only mode of vibration that must be investigated. Where this mode involves either the second or

third orders of excitation, maximum, minimum, or some intermediate engine power condition could be the most critical since the inertia forces can partially cancel out the gas forces under certain operating conditions. All other orders of vibration should be maximum under maximum power conditions. Second modes of the basic crankshaft system may show up on six cylinder in line engines but become definite possibilities in eight and twelve cylinder in line engines due to their longer crankshafts.

(2) The only method to date used by domestic manufacturers to overcome crankshaft torsional vibration problems in aircraft engine has been to incorporate torsional dampers of the dynamic type, which are not really dampers but are devices that neutralize the torque reactions set up by the engine and tune to definite orders of vibration. Other types of crankshaft torsional dampers are used on automotive, marine, and stationary engines and may find use in aircraft but are generally less efficient and heavier than the dynamic type of pendulum dampers currently in use. Very often, crankshaft torsional dampers are installed in engines to reduce torsional excitation only for the benefit of the propeller that is mounted on the crankshaft. These are generally tuned to specific orders of vibration to reduce propeller vibration stresses that are found to be excessive in the operating range when no damping is included in the system.

(3) Crankshaft bending vibration can be either of the resonant or nonresonant (forced) vibration and is experienced in both radial and in-line engines. The problems experienced in radial (both single row and multi-row) engines generally are of the resonant vibration type which results in higher cylic stresses occurring at a particular r.p.m. and power condition. On the other hand, in-line engines generally encounter nonresonant crankshaft bending vibration due primarily to cylinder explosion forces reacting on the crankpins resulting in bending of the crank cheeks.

(4) Due to the complexity of the engine components, fatigue substantiation has been based on endurance testing to accumulate sufficient cycles on the engine components to demonstrate that the fatigue strength of the complete engine system is capable of withstanding the maximum cyclic forces that the engine can produce in service. A vibration test is required to establish the maximum vibratory condition so as to determine the critical r.p.m. and power at which the vibration is a maximum and also, establish the order of vibration so as to determine the number of cycles that would be accumulated for each hour of testing. From these test data, an endurance schedule would be established to determine the r.p.m. and power to be run at for the number of hours which would accumulate 10 million cycles, which is accepted as the fatigue limit for all metal components to be substantiated.

b. Turbine Engines. The method of vibration and fatigue substantiation of a turbine engine is different than the method used for a reciprocating engine primarily, since endurance testing of the complete engine is not similarly applicable.

(1) A turbine engine is a multiplicity of airfoil sections which are generally aerodynamically excited to produce vibration when it exists to a degree that airworthiness must be considered. The airfoils in the engine (compressor blades, turbine blades, fan blades, impellers, inducers, etc.) are subject to foreign object damage which grossly affects their fatigue strength, and, therefore, component fatigue testing will better evaluate their airworthiness. The blade attaching elements (such as discs) can be affected by the excitation forces impinging on the blades and being transmitted through the blade attaching points to the disc resulting in the discs reacting at their own natural vibration modes. If the forces are large enough and react at a frequency occurring in the operating range of the engine, disc modes of vibration should be investigated to determine their safety factors relative to airworthiness.

(2) With the primary source of excitation being aerodynamic in nature, a vibration evaluation should be conducted under at least the worst condition that can exist when in operation. Any flight or ground operation that affects the normal flow of air through the engine should be reproduced while conducting a vibration survey of the rotating engine components since in-service failures of rotating components can result in serious consequence. The airflow through an engine can be affected by a distortion of the air at the inlet at the exhaust of the engine, or within the engine. Inlet distortion can be affected by aircraft maneuvers, suck-in doors, shock waves, or other types of interference. Exhaust distortion can be introduced where reversers or other devices are used for particular operations. Bleed valves or the like can affect the airflow within the engine and should be taken into account.

(3) Highly stressed rotating components which include compressor and turbine discs, disc spacers, fan blades, etc., should be investigated for their low-cycle (start-stop) fatigue strength characteristics. Cyclic stresses resulting from operation from zero r.p.m. up to rated r.p.m. (and temperature) and back down to zero r.p.m. (and ambient temperature) can produce fatigue failures but are not due to vibration in the normal sense.

(4) For components where low-cycle fatigue strength substantiation is necessary, the substantiation can be accomplished on either the complete engine, or full-scale specimens, or on critical portions of particular components. Low-cycle fatigue is always associated with conditions where high stresses are concerned.

Under such conditions, failures will occur after the accumulation of a relatively few cycles as distinguished from normal fatigue which is generally associated with millions of cycles of stress. About ten thousand cycles are considered the border between low-cycle fatigue and normal fatigue phenomena. If the low-cycle fatigue of the engine rotating components is to be substantiated by a cyclic endurance test of the complete engine, it is not practical to require ten thousand start-stop cycles of the engine since one cycle can require as much as twenty minutes due to the cool-down cycle taking so long. Such a test could consume over 3,000 hours of cyclic testing as compared to the normal 150-hour endurance test to certify the engine for all other reasons.

(5) Where containment of failed rotating components cannot be shown as a means for satisfying their airworthiness, strain and vibration tests plus fatigue strength substantiation become part of the demonstration of integrity for those parts in determining their airworthiness.

160. HELICOPTER DRIVE SYSTEM VIBRATION. Propulsion systems of helicopters include the engine and the power drive systems up to the main and tail rotors. Vibration excitation to the drive system components can be either from the engine end(s) or the rotor ends of the system. From the engine end or ends, the excitation is generated mechanically from the forces within the engine and transmitted out into the drive system. From the rotor ends, the excitation is generated aerodynamically from the rotor blade load variations and transmitted into the drive system.

a. The drive system generally constitutes several branches such as the main rotor, tail rotor, cooling fan drive, etc. There are two basic vibration phenomena associated with drive shaft systems as used in helicopters, i.e., bending and torsional vibration. Even though the complete vibration system is involved in any particular mode of vibration of a multidrive system, each mode is generally identified primarily with one branch of the system.

b. To investigate the vibrational characteristics of a helicopter power drive system, all branches of the system should be investigated for both bending and torsion for all power conditions and under both steady state and transient conditions of operation with the engine crankshaft or torque shaft being considered as one branch of the system. Where aerodynamic forces produce the excitation, the drive system should be investigated under all normal flight conditions for the helicopter. Excitation of the system due to transients can be produced during clutch engagements, coming out of auto rotation, or during any condition where the r.p.m. power or flight attitude is changed during operation.

c. The vibration and fatigue substantiation of a helicopter drive system are accomplished partly by endurance testing and partly by component fatigue testing. This becomes necessary since some of the excitation cannot be duplicated by continuous running.

161. UNCONVENTIONAL DRIVE SYSTEMS. Aircraft using unconventional drive systems, which include VTOL and STOL vehicles, generally have system combinations that include fixed wing and rotory wing aircraft components. The vibration and fatigue substantiation of the powerplant components of these systems should be handled by comparable phases as described in earlier portions of this handbook.

162. - 164. RESERVED.

SECTION 5. FLIGHT

165. FUNCTIONS, RESPONSIBILITIES AND PILOT QUALIFICATIONS.

a. General Responsibilities. Flight Test Personnel are responsible for accomplishment of flight tests and evaluation of engineering data on all new or modified aircraft pertaining to performance, flight characteristics, operational qualities, equipment operations, and the determination of operational limitations, procedures, and information. Particular attention and emphasis are to be given to the entire system in which an airman and his aircraft must operate. The system includes not only the airman and the aircraft but airports, air navigation facilities, the air traffic system, the safety rules and operating procedures as well as environmental factors, such as weather.

b. General Pilot Qualifications.

(1) Pilot Skill. Each FAA flight test pilot is expected to be skilled and knowledgeable in experimental aircraft type testing techniques and competent and knowledgeable in aircraft operations under environmental conditions appropriate to the kind(s) of operations for which the applicant is seeking approval. Special training should be requested as needed to qualify individuals in advance of actual need.

* (2) Initial Qualification. Each new flight test pilot employee becomes initially qualified by successfully completing his indoctrination training. This training is either an aircraft certification testing course taught at the Aeronautical Center or, a formal flight test pilot trainee program coupled with on-the-job training.

(3) Pilot Ratings. No additional certicates containing the phrase "All Ratings Authorized" will be issued. When a certification test pilot qualifies for an additional category, class or type rating, he may

(a) Request that his pilot certificate be reissued containing all ratings supported by his airman file, or

(b) Retain his "All Ratings Authorized: and forward his approved rating application and flight test report for inclusion in his airman file to support the additional rating at time of future conversion. Qualification for additional certificates and/or ratings will be accomplished by demonstrating similar competency to a flight operations inspector, or his authorized representative. *

* (c) During the airman competency maneuver development of the type certification program and in conjunction with the FOEB activity as specified in Handbook 8430.6, the appropriate flight test pilots shall receive type rating flight check(s) in the subject aircraft. (Ref.8110.4,165.d.(3)(b)).

(4) Continuing Proficiency. Production surveillance flight testing as prescribed by the program guidelines may be utilized for continuing proficiency and with appropriate supervision, may be a useful source of on-the-job training. *

c. TC/STC Responsibility Qualifications. Before a flight test pilot is assigned responsibility for a TC/STC project, it should be determined that:

(1) The scope of the project is appropriate to his experience, training development, and position description.

(2) He has successfully completed the appropriate FAA type certification flight test training course, has received the equivalent in on-the-job training in type testing techniques and know-how under the supervision of an experienced FAA test pilot or, has otherwise demonstrated his aircraft testing competence and knowledge to an experienced FAA test pilot and the results of which have been reviewed and concurred in by another flight test specialist or supervisor.

(3) He has had related operational experience or training in and knowledge of similar types of aircraft in the kind(s) of operations probable for the type. Whenever possible, he should be competent in and familiar with at least two or three other similar makes and models, including having qualified for the appropriate aircraft rating.

(4) An exception of paragraph (3) is a project in which the prototype is the first of a new basic design classification.

d. Specific Qualifications.

(1) Qualification on Test Aircraft. For type certification testing of prototypes, the applicant is expected to provide, as a part of the flight test program, the necessary first pilot checkout qualification flight time for the flight test pilot(s) assigned responsibility for the project. If additional test pilots not assigned directly to the project need qualification flight training in a manufacturer's prototype, or in first production models, arrangements are to be made to contract for same, through channels, with the Training Division.

(2) Familiarization Flight Time on New Models. Familiarization flying may be arranged for additional flight test pilots as a part of functional and reliability testing, production testing, or during extensive type testing provided it does not impose an additional burden on the manufacturer or interfere with the responsibile region's conduct of the required compliance tests.

(3) Airman Rating Qualification During TC/STC Tests. Each type certification project involving a new design is to include those airman competency tests and maneuvers (when determining compliance with the general controllability and maneuverability requirements) which are required of a civilian pilot to be competent to operate the aircraft in the kind of operation(s) and atmospheric conditions for which it will be approved.

* (a) The airman competency maneuvers are to be developed by the assigned Engineering Liaison Operations Specialist during the type certification program, perferably during the functional and reliability testing to assure satisfactory determinations of speeds, handling characteristics and systems operation for such maneuvers. *

(b) If the aircraft undergoing type tests involves a new or different airman certificate or rating under the applicable operating rules, the required airman competency maneuvers are to be reported on the appropriate FAA Form 8410-2 or FAA Form 8420-3. The original is to be forwarded through channels and made a part of the flight test specialist airman record file to show that he has qualified for the pertinent aircraft rating. A duplicate is to be made a part of the type inspection report.

e. Physiological Training Required for Participation in High-Altitude TC/STC Flight Tests.

(1) FAA personnel participating in flight tests above 10,000 feet where oxygen equipment is normally used or on high-altitude flights in pressurized aircraft will comply with FAA Order AM 3121.1 dated November 26, 1962.

(2) Some important points of this Order are:

(a) Training is required for pilots, flight engineers, and other individuals whose proper performance of duty is necessary for safety of high-altitude flight.

(b) The required training will be accomplished at the Federal Aviation Aeronautical Center or at military installations having low-pressure chambers.

(c) Recurrent training is required every three years.

(d) Complete description of required course and procedure for applying are included in the Order.

* f. Actions Prior to Official Type Tests.

(1) Official Flight Tests. Official flight tests should not be started until a TIA has been issued. All official tests should be conducted in accordance with whatever restrictions and/or limitations that are set forth as necessary to safely conduct the tests to determine compliance with the regulations applicable to the model being tested. This includes DER flight tests. *

(2) Conformity of Test Article with Type Design. Prior to starting any official approving flight tests the responsible test pilot for the project and ground inspection personnel should verify that a conformity inspection has been conducted to assure that the airplane is in satisfactory airworthiness condition for the particular flight test(s) being conducted.

(3) Checkout on Test Aircraft. The assigned project test pilot(s) is/are to arrange with a responsible official of the applicant's organization for an adequate and agreed upon checkout in the applicant's airplane. The checkout should be accomplished prior to the FAA pilot(s) conducting any official flight tests requiring action in an official flight test pilot capacity.

(4) Command Pilot. The pilot-in-command is the applicant's pilot.

(5) Emergency Provisions. The project test pilot(s) should make sure all necessary safety equipment is provided and that all crewmembers know and are briefed in the usage of this equipment. The pilot(s) should anticipate the possible emergencies that could occur for a particular test phase and outline crew duties in the event an emergency is encountered.

g. Test Flight Planning. Each test flight should be carefully planned prior to actual flight. A written schedule of what will be done during the test should be agreed on by the applicant and FAA flight test personnel. The agreed upon schedule should indicate the applicable FARs to which the flight tests are being conducted.

h. Hazardous Flight Tests. FAA flight test personnel are not authorized to participate in or conduct potentially hazardous flight tests until the applicant has successfully performed these tests and a report submitted.

* i. Certification Flight Hours.

(1) The recording of certification flight test time by the FAA flight test crew (pilot and/or engineer) should include all flights during which an FAA crew member is conducting required evaluations, including flight to and from local test areas, flight in the traffic pattern, etc. It also includes time required to conduct or witness systems evaluations and other certification tests, regardless of whether an FAA pilot is at the controls. Initial pilot familiarization may be considered official test time even though no specific tests are conducted.

(2) Certification flight time does not include ferrying to remote areas, or tests conducted for purposes other than determination of compliance, regardless of whether an FAA pilot is at the controls. *

166. GENERAL DUTIES.

a. Flight Operations-Specialist Participation-Transport Category Airplanes. The Flight Operations Specialist will participate in engineering flight tests on a noninterference and selective basis to become familiar with the aircraft. Participation in engineering flight tests will include flying operationally oriented test maneuvers during functional and reliability testing as well as other phases of the type certification flight test program. The latter will be accomplished under the supervision of the Project Test Pilot or Chief, Flight Test Branch/Section; and no additional flying will be imposed upon the manufacturer. The amount of flying will be to the extent necessary to discharge the responsibilities as a member of the FOEB.

(1) Participation in STC projects will include Category II flight testing; autoland flight testing, etc.

(2) Operational acceptability determination will include evaluation of aircraft warning systems; i.e., instrument failure warning, landing gear warning, progress or situation displays, and all other items or equipment used operationally.

* b. Cockpit Arrangement and Control Operation. Flight test personnel are responsible for the location, operation, and readability of all cockpit instruments, controls, markings, and operational placards to insure that the flight crew will be able to perform all of its duties without unreasonable concentration, fatigue, and without the likelihood of incorrect operation. Particular attention is to be given to potential sources of crew error, overtaxing crew's ability, and to the emergency procedures.

(1) When evaluating these items, it is expected that crews of average skill for the operations approved must be able to consistently execute the normal and emergency procedures under the adverse operating and weather conditions that are expected to be encountered in service.

(2) On transport type aircraft, an appropriate time to evaluate an average flight crew's ability to cope with emergency situations and to follow procedures and limitations established for the aircraft would be the initial airman's type rating test on the aircraft during type certification functional and reliability tests. In other instances, this may be accomplished during airline crew flight training at the manufacturer's facility under a provisional type certificate. *

c. Functional and Reliability Testing. The FAA Flight Test Pilot/Specialist assigned to the certification program will be in charge of and coordinate all matters for the Type Certification Board pertaining to official functional and reliability testing. He or a properly designated alternate will participate in all flights. He will collaborate with the manufacturers' pilots in all appropriate activities, particularly in regard to flight plans and procedures. The manufacturers' pilots should be in command of all flights, but FAA pilots will fly the airplane sufficiently to ascertain the proper functioning and reliability of the airplane, its components and equipment. This will include operation in the kind(s) of operation (ref. FAR 25.1525) to be approved.

(1) The flight operations member of the Type Certification Board will participate in the functional and reliability flight tests to the extent necessary to evaluate operational requirements. Other FAA personnel (e.g., representatives of other branches and specialists) will be requested by the Type Certification Board to participate in the flight program when their assigned responsibilities are within the scope of the type certification program. All participants will advise the flight test representative in charge of the program of any special inspections or observations that are to be made, and flights in which they intend to participate. Results of such inspections or observations should be made available to the flight test representative in charge.

(2) The Flight Test Pilot/Specialist will brief the Type Certification Board during the official program so that all participating personnel have an understanding of the procedure to be followed.

d. Helicopters.

(1) Introduction. Airframe and equipment engineers are responsible for the structural approval of the main and tail rotors. This includes the evaluation of strength, fatigue and flutter of rotors, rotor hubs and controls. The flight strain program, which is an integral part of the fatigue evaluation, should be coordinated with flight test personnel. Propulsion engineers are responsible for the endurance testing and design evaluation of the transmission and drive systems.

(2) Interorganizational Coordination. Examples of instances where coordination is necessary are as follows:

(a) Flight Controls. During these tests, it is necessary that the flight controls be operated at various rates of movement. Flight test personnel will determine that the movements of the flight control are representative of the

severity of application that will be encountered in actual service.

(b) Rotor Strain Gage Program. Since the design limits, e.g., rotor r.p.m. (maximum and minimum), airspeed, blade angles (thrust, weight, etc.) are generally based on the fatigue life of the rotor system, it is necessary that flight tests be conducted at limits that are appropriate for the particular helicopter and at the corrected combination of these limits. It will be the responsibility of flight test personnel to determine that the flight-strain gage program includes conditions of flight at the various combinations of rotor r.p.m., airspeed, thrust, etc., that will be representative of the limits used in service and at a wide enough range so as not to require exceptional piloting skill to operate the helicopter within these prescribed limits.

(c) Maneuvering Load Factor. When the manufacturer elects to substantiate maneuvering limit load factors less than 3.5, analytical study and flight demonstration are required. It will be flight test personnel's responsibility to determine that the manufacturer has conducted the flight demonstration in a manner so as to show that the probability of exceeding the load factor selected is extremely remote.

167. MULTIPLE-EXPERT-OPINION EVALUATIONS OF QUALITATIVE/SUBJECTIVE DESIGN FEATURES. (RIS: FS 8110-10)

a. Purpose. A multiple-expert-opinion evaluation may be used for determining compliance of controversial qualitative flight test certification design and operational features. This type of evaluation should be employed on an agency-wide basis whenever regional personnel feel that the issue is subject to controversy, precedent-setting, and/or transcends the local region's concern, for which specific guidelines and criteria have yet to be developed and issued.

(1) Determination of FAR compliance on an "equivalent level of safety basis" usually involves a qualitative analysis of an aircraft which possesses design features which do not meet the "letter of the regulation" or are not clearly covered in the applicable regulations.

(2) Determination of compliance in such instances is based on meeting the intent and objective of the applicable regulations and whether compensatory factors exist or operational limitations are applied which will result in an "equivalent" safe operation.

b. Responsibility. The responsibilities of the affected region are: first, to determine that the design feature in question involves the conditions of paragraph a. and warrants this type of evaluation; second, to initiate action to implement the procedure; and third, to include experts from Washington and from other regions which are likely to have or expect related features in its projects.

c. Procedure. The judgments of at least three expert persons should be used to make a determination of compliance with regulations involving qualitative/subjective standards when there appears to be a possible unsafe feature, a requirement application susceptible to nonstandard interregional administration, or when a marginal equivalent level of safety design feature is involved.

(1) Following determination that a multiple-expert-opinion compliance evaluation is necessary, a written request is to be forwarded by the regional branch chief to Washington and to the other regions which specifies the nature of the design feature and the details for the participation needed. In determining the participation needed, systemworthiness is to be considered. For example, Operations, Research/Development, Air Traffic, and Airports representatives should be invited to participate in the evaluation when the item in question may affect their areas of responsibility.

(2) The Chief of Flight Test for the region involved, or other team leader appointed by him, will direct and manage the team's activities while at the applicant's facility. He will be responsible for all meetings and discussions held between the applicant and FAA and for meetings held by FAA personnel only. He will be the spokesman for the FAA at the conclusion of the investigation and will initiate action to inform the applicant of the findings, in writing, as soon as possible.

(3) An initial meeting will be held with the applicant and all FAA participants to describe the purpose of the evaluation and to schedule the program.

(4) Each evaluator will be supplied with a checksheet prepared by the team leader. The format will include at least the following:

(a) Reference regulation.

(b) Problem.

(c) Findings.

(d) Recommendations.

(e) This checksheet will be completed, signed, and returned to the team leader. The consolidated report will then become a part of the TIR, Part II.

(5) After all FAA participants have independently reached a conclusion, the team leader shall convene the FAA personnel, independent of the applicant's personnel, to establish the conclusion(s) of the majority and minority, if any, of the members.

(6) The applicant may be orally informed of the team's findings and recommendations subject to written confirmation and higher approval.

d. Report.

(1) A written report of the team's findings, signed by the Chief of the Engineering and Manufacturing Branch, will be forwarded to: the applicant, the Chief, Engineering and Manufacturing Division in Washington, and to all regions. This report is to be forwarded not more than five working days after the conclusion of the evaluation.

(2) If the team has determined that, due to the results of the evaluation, guidance material and/or a regulation change is needed, such recommendations should be incorporated in the report and the Washington representative will initiate appropriate action.

168. TYPE INSPECTION REPORT (TIR).

a. Purpose.

(1) The purpose of the TIR is to provide an official record of the inspections and tests conducted to show compliance with the applicable regulations and provide a record of other information pertinent to each TC/STC project.

(2) A TIR consists of Part I, Ground Inspection - prepared by manufacturing inspection personnel; and Part II, Flight Test Report - prepared by flight test personnel.

b. Flight Test Report Preparation. A TIR should:

(1) Be prepared for each TC/STC project for which a TIA is issued.

(2) Be completed within 90 days after TC/STC issuance.

(3) Contain the results of all official TC inspections and tests.

(4) Contain a chronological list of all changes made to the prototype airplane and identified as made by the applicant or required by FAA as a result of type tests showing noncompliance.

(5) Be approved by the responsible supervisors.

(6) Be retained by the certificating region for reference purposes.

(7) On request, a copy prepared for the applicant provided all internal FAA and proprietary information is removed.

c. Administrative Information. The administrative information should be included in Section "0" of the flight test portion of each type inspection report.

(1) Airmen Competency Maneuvers. Include a statement and, if applicable, attach a copy of FAA Form 8420-3 or 8410-2 (ref. Par. 165.d(3)) which sets forth whether the type certification flight tests included all the airman competency and training maneuvers applicable to the type for the kind of operations approved.

(2) Flight Operational Conditions. Include a statement which describes those operational conditions and maneuver combinations experienced which would be representative of the more critical situations considered probable for the type. This will assure a record for future reference to show what was actually observed or encountered during official flight tests ". . . under all conditions of operation probable for the type . . . " (ref. general controllability requirements) that is not otherwise recorded. Specifically, the statement should include the environmental conditions, configurations, and the maneuvers performed such as:

(a) The degree of turbulence and/or precipitation involved (operationally severe, moderate, mild) with the type of maneuvers (turns, climbs, stalls, etc.), readability of instruments in turbulence.

(b) The runway and weight conditions (maximum landing weight, light weight, wet, slippery, slush, sod,.etc.) with the type of landing or takeoff (maximum braking, crosswind velocity and angle, obstacle clearance, etc.).

(c) Other useful reference information not included elsewhere in the TIR. A descriptive statement is not necessary for routine or ideal testing conditions or on maneuvers otherwise reported.

* (3) Minimum Equipment List. The preparation and approval of a MEL is the responsibility of the Flight Operations Evaluation Board (FOEB) of which the supervisory flight test pilot or his designated representative is a member. A listing of those equipment items rendered inoperative during and incidental to type tests which are considered satisfactory for inclusion on the minimum equipment list for dispatching with inoperative equipment shall be provided to the Flight Operations Evaluation Board for consideration *

169. AUTHORIZATIONS FOR OPERATION WITH INOPERATIVE EQUIPMENT.

a. Type Certification Board Determination.

(1) Alternative operational limitations should be included in the AFM if operation is to be authorized with any required minimum equipment item or required system inoperative, provided reasonable operational envelope is assured as well as an equivalent level of airworthiness.

(2) Optional or extra equipment relating to basic airworthiness (other than communications, navigation, and special safety equipment) that is over and above that required as a minimum to type certification, should be identified in the type certification data sheet, or in the TIR for ready reference and inclusion as desired by the Flight Operations Evaluation Board in the minimum equipment list.

* 170. CERTIFICATION OF AIRCRAFT WITH CONFIGURATION DEVIATION LIST(s) (CDL).

a. General. Aircraft certificated under the provisions of FAR 25 or CAR 4b and intended for use under the operating rules (FAR 91, 121, and 123) may be approved for operations with missing secondary airframe and engine parts by the type certificating region under an amendment to the type certificate.

b. Approval of Configuration Deviation List (CDL). The aircraft manufacturer develops the CDL when operator service experience indicates a need, and submits it with his recommendations to the type certificating regional office for approval by engineering personnel and the Flight Operations Evaluation Board. When approved, the CDL is incorporated into the LIMITATIONS section of the Airplane Flight Manual as an Appendix to that section. The CDL is NOT a part of the Minimum Equipment List (MEL). However, a copy may be attached to the operator's MEL for easy and ready reference by flight crews. This appendix to the AFM will:

(1) Clearly define "that the limitations in the basic manual must be followed except as noted in the appendix."

(2) The Limitations section must contain a statement similar to the following: The FAA approved limitations must be followed when operating under a configuration deviation.

(3) Include any and all flight operations restrictions or limitations, as applicable, associated with each missing secondary airframe and engine parts.

(4) Itemize the configuration deviations in a standardized format, as approved by the certificating region.

(5) Clearly indicate that a placard of the associated limitation(s) will be affixed in the cockpit in clear view of the pilot - in-command and other appropriate crew member(s).

(6) Indicate that no more than one part itemized on the configuration deviation list (CDL) may be missing for continuing flight, unless consideration has been given and designated combinations are provided for on the CDL. NOTE: Air Carrier Operations Inspectors Handbook, 8430.6A, will contain a requirement that the pilot-in-command will be notified of the CDL part(s) through an appropriate notation in the aircraft log book. *

* c. Aural Speed Warning and Airspeed Limit Hand. The determination of whether the aural speed warning and barber pole should be reset will be made in accordance with the following:

(1) Configuration Deviation List(s) may not contain items requiring a reduction in V_{MO}/M_{MO} unless the airspeed limit speed hand and the MACH airspeed warning system are programmed for the altitude/speed schedule specified for the applicable CDL(s).

(2) No changes to the visual or aural warning devices will be required if:

(a) It can be established by flight test that no significant changes of the flight characteristics or any other adverse airworthiness effects exist up to and including V_{MO}/M_{MO}; and

(b) An acceptable rational analysis is made for speed to V_D/M_D to show no significant changes of flight characteristics or any other adverse airworthiness effects will exist up to and including that speed.

d. Implementation.

(1) Existing approved Missing Parts List (MPL). These MPLs will be implemented into the CDL procedures in accordance with paragraph 170, a, b, and c. This should be accomplished in a timely manner, after consultation with the manufacturer and/or operator on an acceptable schedule for completing the program. In no case, however, will the implementation extend beyond six months from the date of this handbook change.

(2) Configuration Deviation List (CDL). Existing and future applications will be processed in accordance with the procedures outlined in this paragraph 170. *

171.-173. RESERVED.

SECTION 6. OPERATING LIMITATIONS AND INFORMATION

174. AIRCRAFT FLIGHT MANUALS.

* a. Approvals. Required flight manuals are to be approved by the regional Chief, of Engineering and Manufacturing Branch. For transport category aircraft, the AFM will not be approved until a recommendation for approval of the AFM has been received from the Project Flight Test Pilot and the Operations Specialist in writing, of the limitations, normal and emergency procedures. The review and the recommendation for approval of the performance section of the airplane flight manual is the responsibility of the assigned flight test engineer prior to acceptance by the Chief, Engineering and Manufacturing Division/ Branch. This also includes AFM revisions and supplements. *

b. Manual Revisions/Supplements.

(1) Changes to flight manuals submitted by the original applicant will be handled in the same manner as original manuals. Each revised page should bear a revision date or symbol so that required revisions may be properly identified. Changes or revisions to flight manuals, submitted by other than the original applicant (holder of type certificate), should be covered by the use of a supplementary log of the revised page rather than incorporating the pertinent revision in the original applicant's basic log of revision pages.

(2) Where revisions are submitted to a region other than the controlling region, such revisions must be referred to the controlling region in triplicate together with recommendations regarding approval.

c. Manufacturer's Manuals - For Airplanes/Helicopters (6,000 pounds or Less). If an operator's handbook, manual, or other document is provided by the manufacturer in lieu of an approved flight manual, or is provided in addition thereto, the information, limitations and procedures therein that are required in an approved flight manual are to be verified for correctness, completeness and, if an approved manual is also issued, for consistency therewith. The manufacturer's manual need not be "approved" by the regional chief but inconsistencies, errors and any other information which may promote unsafe operations should be brought to the attention of the applicant.

d. Flight Manual Distribution. One copy of each TC and significant STC manual (having a significant effect on flight performance, characteristics or procedures) and of any significant revisions/ supplements thereto are to be sent, within 30 days after TC/STC issuance, to Washington, attention Flight Test Branch, Engineering

and Manufacturing Division. (Applies also to manuals issued under a delegation option, provisional TC, and to manufacturers' manuals issued in lieu of, or in addition to, approved flight manuals.)

e. Presentation of Takeoff/Landing Performance Information. To assure the operator of meaningful information.

(1) Assure that the operator is informed of the exact test performance procedures used in obtaining the test distance, including environment conditions.

(2) Urge each applicant, other than FAR 25 manufacturers, to include factors or charts showing effect on distances from wet surfaces.

(3) Urge the presentation of AFM performance information in a simple and practical form for use by the business operators.

(4) FAR Part 25 Airplanes.

(a) During functional and reliability tests, operate airplanes into and out of airports with runways that are representative of the distances set forth in the AFM. This should include the type of operation for which the airplane has been approved, namely; IFR, night, and VFR.

(b) Assure that either performance charts or clear statements are included which reflect the 60 percent and other factored distances which are applicable to operations under FAR 121.

175. AUTHORIZATIONS FOR OPERATIONS WITH INOPERATIVE EQUIPMENT. Refer to Section 5, paragraph 168.c.(3), for information relating to the minimum equipment list for GO-NO-GO.

176. PUBLIC DISCLOSURE OF AIRPLANE FLIGHT MANUALS.

a. The Airplane Flight Manual is necessary for the safe operation of an airplane and is therefore considered public information. The Administrator has determined, (as published in the Federal Register) that public disclosure of Airplane Flight Manuals is required in the interest of the public.

177.-192. RESERVED.

CHAPTER 4. DELEGATION OPTION AUTHORIZATION PROCEDURES

178. GENERAL. The holder of a Delegation Option Authorization (DOA) is required to continually meet the requirements for issue of the authorization. To discharge his duty in promoting safety as prescribed in the Act, the Administrator is required to conduct inspections of the holder's organization, facilities, product and records relative to certification programs of manufacturers who are holders of a DOA. This chapter defines the procedural requirements and responsibilities of the DOA holder and the FAA in the DOA programs.

179. PROCEDURES HANDBOOK.

a. The manufacturer shall prepare a Delegation Option Procedures Handbook which will outline the procedures to be followed in type certification, revisions to the production certificates, issuance of airworthiness certificates, repairs and alterations, service difficulties, and all other functions within the scope of the delegation.

b. The procedure for processing the technical data required for type certification and revisions to the production certificate must be outlined in the Procedures Handbook.

* c. The names, signatures and titles of those approved to make findings of compliance with applicable airworthiness standards, and sign airworthiness certificates, repair and alteration forms, and inspection forms shall be included in the Procedures Handbook. *

d. The Handbook shall include provisions for a central certification office, known as the DOA Coordinator, for coordination and accrual of certification data, including a compliance checklist, and to provide a control point for communication with the FAA as it relates to interpretation of regulations, policies, procedures, etc.

e. The handbook will include the procedure, including timing, for the submittal, review and approval of changes to the DOA procedures, forms and personnel.

f. The Procedures Handbook (and revisions thereto) must be reviewed and approved by the Chief, Engineering and Manufacturing Branch of the pertinent regional office of the FAA.

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180. POLICY AND INTERPRETATION COMMUNICATION

a. To assure that all DOA manufacturers have the same policy/interpretative material, the regional offices will transmit all policy/interpretative material that applies to the DOA maufacturer received from AFS-100 verbatim to the manufacturers.

b. Periodic symposia, initiated by AFS-100 and attended by AFS-100, the various regional offices, and the DOA maufacturers, will be conducted.

181. SERVICE DIFFICULTIES. The timely disposition of service difficulties is to be given priority handling. No set time period can be defined in this handbook since each incident is unique and must be handled accordingly. Particular care should be given to properly documenting the method by which the item is resolved.

182. PERSONNEL QUALIFICATIONS OF DOA PERSONNEL. Qualifications of the personnel responsible for making findings of compliance shall include but not be limited to the following:

a. Be in the employ of the maufacturer.

b. Have a thorough working knowledge of the pertinent FAR.

c. Have been in a responsible position in connection with the type of work for which he is to be responsible and be entirely cognizant of related technical requirements and problems related to civil approval.

d. Possess integrity, sound judgment, and a cooperative attitude.

e. Have a position in his employer's organization with sufficient authority to enable him to administer effectively the pertinent FARs.

f. Have four years of appropriate experience plus an appropriate engineering degree from a college or university of recognized standing. Two years of appropriate experience may be substituted for each year of formal education.

g. The DOA Coordinator shall meet the requirements of Paragraphs 182a through 182f, and shall have demonstrated to the FAA his capability of obtaining compliance with the FARs.

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h. In addition to the requirements of 182a through 182e, a DOA flight test pilot:

(1) Must have a minimum of 200 hours flight time in the conduct of experimental flight tests, including significant participation as a pilot in at least one complete, or the equivalent in several partial, type certification program(s).

(2) Must have a minimum of 50 hours of experimental flight testing experience in the class of aircraft involved. (Single-engine airplane, multiengine airplane, rotorcraft.)

(3) Must have at least a currently valid commercial pilot's certificate with instrument rating and with ratings appropriate to the class of aircraft being certificated.

(4) Must have for fixed-wing aircraft, minimum of 1,750 hours flight time as a pilot-in-command (pilot rating category) of which 50 hours were logged within the past 12 months. For rotary wing aircraft, a minimum of 1,000 hours as pilot-in-command (pilot rating category) of which 50 hours were logged within the past 12 months.

(5) Credit for satisfactory completion of the FAA Test Pilot School (when established) may be substituted for 150 hours of the flight test experience required in Paragraph 182 h (1).

i. A DOA manufacturing inspection representative must possess the qualifications set forth in Paragraphs 182 a through 182 f except that Paragraphs 182 c and 182 f are revised as follows:

c. Have been in a responsible position in the particular discipline for which he is assigned cognizance. He must also be familiar with the facilities, procedures, and manufacturing and inspection techniques in connection with type certification.

f. Have a minimum of four years experience in connection with the inspection or production of products similar in type or complexity to those produced by his employer. At least two years of such experience must have been in a supervisory capacity or other position of equal responsibility.

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183. CERTIFICATION. Type Certification Board meetings will be held in accordance with Chapter 2 of this Handbook. The FAA will conduct Preliminary and Final Board meetings on major programs and any other meetings necessary to accomplish the objectives referred to in these procedures. Scheduling of the meetings will be through FAA/ industry coordination. During these meetings, the FAA will:

a. Establish applicable certification basis.

b. Identify areas requiring formation of special conditions.

c. Provide special attention, information and guidance resulting from new design concepts, service experience, agency's policy and current state-of-the-art considerations.

d. Establish those areas of the type certification program where the FAA will make findings of compliance. (See Paragraph 184).

e. Coordinate program scheduling to the degree necessary to accomplish the required FAA participation established in paragraph d. above.

f. Identify areas requiring the formation of critical design review teams as defined in 8110.4, Chapter 2, Section 1, item 21.

g. Establish that those areas involving direct FAA participation have been satisfactorily completed.

h. Review DOA Certification Program.

i. Review applicable noise and emission requirements and establish the nature and extent of tests and substantiation expected from the manufacturer.

184. FAA PRE-TYPE CERTIFICATION FINDINGS OF COMPLIANCE. The FAA will make findings of compliance prior to type certification of a product.

a. Rule Changes. The FAA will participate in the determination of compliance to rule changes critical to safety which the manufacturer does not have certification experience.

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* b. Policy and Procedural Changes. The FAA will review and/or participate in those areas where policy or procedural changes have been made since the manufacturer's last TC program.

c. Service Experience. The FAA will review and/or participate in the determination of compliance in those areas where the manufacturer has had service problems.

d. New Design Concepts. The FAA will participate in the determination of compliance with those rules, policy, and procedures with which the manufacturer has not had previous experience.

e. Design Areas Critical to Safety. On the basis of the FAA's overall knowledge of the manufacturers technical expertise, the FAA will review and/or participate in findings of compliance in those design areas critical to safety.

f. Flight Testing of Critical Areas. The FAA will conduct flight tests of the aircraft's flight, ground and water characteristics critical to safety and determine there are no unsafe characteristics. If review of the DOA manufacturer's flight test program indicates the need for further tests, the FAA will accomplish any additional testing deemed necessary.

185. RESERVED.

186. FAA AUDITS. Audits of the manufacturer's engineering and manufacturing facilities will be conducted when changes in company policy, personnel, or management could affect the manufacturer's ability to function properly under the DOA system, or when deemed necessary under FAR 21.249. An audit will be conducted to determine the adequacy of a new applicant to function under DOA.

a. Audit Organization. The Delegation Option Audit Board should consist of personnel qualified to investigate the DOA holder in those areas determined to be questionable by the Administrator.

b. Audit Planning. An audit should be carefully planned so that it may be conducted in an efficient and orderly manner. The following areas should be considered in the planning of the audit:

(1) Certification activity at manufacturer's production and supplier facilities, including review of Type Inspection Reports, and conformity and airworthiness certification procedures.

(2) Service record of products including review of Maintenance Analysis Center information prior to audit. *

* (3) Rules and airworthiness standards selected for review.

(4) Organization.

(5) Areas to be evaluated.

(6) Establish audit teams.

(7) Procedures to be used in conducting audit.

(8) Reporting of findings.

(9) Audit report and follow-up actions.

c. Procedures for Audit. When the region has completed plans for an audit, the Chairman must then notify the highest appropriate level of the company of the pending audit. The notification should include the starting date, scope of audit, schedule and any special requirements for inspection or tests including flight tests deemed necessary.

(1) Prior to the start of the audit, the Chairman should convene the Board to discuss the audit plans, personnel assignments, and any other items relative to the audit. The Chairman should emphasize to the Board that the audit must be conducted in an efficient and professional manner to be effective and meaningful.

(2) To start an audit, the Audit Board should arrange for a meeting between the DOA holder's representatives and the members of the Audit Board. The Chairman of the Audit Board should explain the purpose of the audit, the schedule, subjects to be investigated, products to be inspected, and the plan for inspection.

(3) The members of the Board, as assigned, should conduct an inspection of the DOA holder's facilities, data, and systems to ensure that compliance with the applicable requirements for type, production, and airworthiness certification has been demonstrated. The individual Board member's findings should be recorded in accordance with the sample format of Appendix 3, Figure 5-8. All findings should be thoroughly reviewed by the member and signed prior to presentation as a...

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item. Audit Board members should maintain frequent informal contact with each other and the Board Chairman to ensure that problems which cross technical specialty areas are properly followed and handled.

(4) Flight tests or inspections, in addition to those scheduled in advance, may be conducted if data uncovered during the audit indicate their necessity.

(5) The Audit Board should hold private meetings as necessary to discuss the Board's findings and to decide the appropriate category in which the items should be placed.

(6) The categories of the findings should be based on the relative importance of the item. The following are suggested:

a Compliance items - those items which do comply with the applicable airworthiness regulations and certification procedures.

b Improvement items - those compliance items that are presented to the holder for his review and recommendations for his consideration.

c Noncompliance items - those items which do not comply with applicable airworthiness regulations or certification procedures.

(7) Production certification inspection is to be conducted by QASAR in accordance with QASAR Order 8000.25, and scheduled in accordance with Order 8120.3.

(8) When the Audit Board has completed the inspections, the items which will be presented to the DOA holder (at the level at which initial notification was given) should be summarized; and the Chairman should arrange for a meeting with the holder to advise him of the findings. This will allow the holder to undertake appropriate corrective action without delay. The holder should also be advised that he will be notified officially by letter at a later date. The Board should prepare a record which will contain the final findings and recommendations. This report should be a summation of the individual reports submitted by the Board members and should contain supporting data for each item.

d. Official Notification to the Delegation Option Authorization Holder. A formal notification of the findings of the Audit Board should be prepared and forwarded to the holder as soon as possible, not to exceed fifteen (15) working days following the conclusion of

* the audit activity at the facility. The written notification, signed by the Chairman, should cover those findings and recommendations where the region desires action or an investigation. The DOA holder should be requested to submit written comments within thirty (30) days after receipt of notification of findings regarding corrective actions taken on each of the items involving noncompliance with the pertinent regulations. Within sixty (60) days subsequent to the closing of the audit, all findings of noncompliance should be resolved (with the possible exception of those referred to Washington for adjudication). An attempt should be made to complete the closeout report within 90 days subsequent to the termination of activity at the facility. Reference should be made to the Compliance and Enforcement Procedures Handbook, 8030.7A, to ensure consistency with current agency procedures.

e. Audit Report and Follow-up Action.

(1) Follow-up Action. A follow-up system should be established by the region to ensure that appropriate corrective actions have been satisfactorily initiated prior to closeout report. Correction of each noncompliance item should be accomplished to the satisfaction of the Board. Verification by reinspection may be required as deemed necessary by the Board. If deemed necessary, the Board should conduct a reinspection of the facility prior to the closeout of the audit. The original closeout report should be retained by the branch/division conducting the audit.

(2) Final Action. The DOA holder will be notified by letter, signed by the Chief of the Engineering Division/Branch of the auditing region, that:

a All audit items have been resolved to the satisfaction of the controlling region, and the holder's authorization remains in effect; or

b The holder's authorization remains in effect; however, certain limitations are being applied; or

c The Delegation Option Authorization is to be revoked because there are noncompliance items on which the holder has failed to take corrective action, or he is otherwise demonstrating that he is not qualified to be a representative of the Administrator.

(3) Closeout Report. At the closeout of the audit, the controlling region will compile a report containing at least the following:

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* a Summary of individual comment items.

b Corrective actions taken by DOA holder and/or FAA, including date.

c FAA acceptance of response.

d Board recommendations as to the continued operation of the manufacturer under DOA.

e Individual team reports summarizing their overall activities and general findings during the audit.

f Generalized statement of overall findings.

g Disposition of FAR noncompliance items.

187.-192. RESERVED.

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CHAPTER 5. DESIGNATED ENGINEERING REPRESENTATIVES

193. GENERAL.

a. Part 183 of the Federal Aviation Regulations prescribes the requirements for the issuance of designations to private persons to act in the capacity of FAA Flight Standards representatives in the examination, inspection, and testing necessary for the issuance of aircraft certificates by the Administrator.

b. An individual may request appointment for himself, and an engineering consulting organization, manufacturer of aircraft or aircraft components, an air carrier, or a certificated repair station, may request appointment of individuals in their employ as a representative of the FAA. Nominees meeting the requirements for appointment as outlined herein will be authorized to represent the FAA in determining the compliance of aircraft, aircraft components, aircraft and appliance repair or alterations, with the requirements of the FAR. He will serve as a direct representative of the FAA in the performance of his duties as a DER. He will be guided by the same requirements, instructions, procedures, and interpretations as FAA employees in the performance of those duties.

c. All designations are applicable to new aircraft and to the repair and alteration of previously certificated models unless otherwise indicated.

d. A designee appointment will be limited to those fields of engineering, or specific sub-fields therein, for which the designee is considered qualified.

194. TYPES OF ENGINEERING DESIGNATIONS AND PRIVILEGES.

a. Structural Engineering Representative - may approve, within the limits of his appointment, structural engineering drawing lists, data relating to strength, flutter prevention measures, materials and processes used in structural application and other related structural application and other related structural considerations, provided these items have been determined to comply with pertinent FAR. Such authority is applicable to both new and modified models except that basic load analysis and overall test programs for new models may not be approved by Designated Engineering Representatives.

b. Powerplant Engineering Representative - may, within the limits of his appointment, approve engineering reports, drawings, and data relating to powerplant installations, including all systems and equipment necessary for the proper operation of the powerplant when such items have been found to comply with pertinent FAR.

c. Systems and Equipment Engineering Representative - may, within the limits of his appointment, approve engineering reports, drawings, and data relating to phases of aircraft design not covered by structural or powerplant representatives provided these items have been determined to comply with pertinent FAR. He may also approve modifications to equipment including, but not all, equipment and systems other than those of a structural, powerplant or radio nature.

d. Radio Engineering Representative - may, within the limits of his appointment, approve engineering reports, drawings, drawing lists, test, and test data relating to the design and operating characteristics of radio equipment being manufactured and/or relating to the installation thereof, provided these items have been determined to comply with pertinent FAR; inspect prototype and production units submitted for certification to ascertain that their mechanical construction is in accordance with good practice; and approve modifications to equipment.

e. Engine Engineering Representative - may, within the limits of his appointment, approve engineering reports, drawings, and data relating to durability, materials, and processes employed in engine design, operation, and maintenance when these items have been determined to comply with pertinent FAR.

f. Propeller Engineering Representative - may, within the limits of his appointment, approve engineering reports, drawings, and data relating to durability, materials, and processes employed in propeller design, operation, and maintenance, provided these items have been found to comply with pertinent FAR.

g. Flight Analyst Representative - may, within the limits of his appointment, prepare and approve performance flight test data and quantitative operating and flight characteristics data.

h. Flight Test Pilot Representative- may, within the limits of his appointment, conduct any flight tests of both new and modified aircraft. The extent and conduct of the overall flight test program should be coordinated with the local FAA regional office prior to initiation of the flight test program.

195. QUALIFICATIONS.

a. All Designated Engineering Representatives must:

(1) Be in the employ of and recommended by the engineering consulting agency, manufacturer, air carrier, or certificated repair station. This does not apply in the case of self-employed individuals.

(2) Have a thorough working knowledge of the pertinent FAR.

(3) Have been in a responsible position in connection with the type of work for which he is to be designated and be entirely cognizant of related technical requirements and problems related to civil approval or have otherwise demonstrated his suitability for this designation.

(4) Possess integrity, sound judgment, and a cooperative attitude.

(5) Have a position in his employer's organization with sufficient authority to enable him to administer effectively the pertinent FAR. This does not apply in the case of self-employed individuals.

(6) Have at least one year of experience in direct contact with the FAA in which he was actively engaged in the processing of engineering work for FAA approval, of the type for which he is seeking appointment. His experience in obtaining FAA approvals must have been such as to enable the FAA to determine that the applicant is cognizant of the technical problems encountered in obtaining such approvals. The applicant's experience must also indicate to the FAA that he is technically competent to successfully solve the engineering problems within the scope of his designation and his presentations to FAA must have been satisfactory. Education in aeronautical, mechanical, civil, or electrical engineering successfully completed at a college or university of recognized standing may be substituted, year for year, for the eight years of experience required in subparagraph b of this paragraph to a maximum of four years. However, formal education may not be substituted for the one year of experience in direct contact with the FAA.

b. For engineering designees, except Flight Test Pilot Representatives, at least eight years of progressively responsible aeronautical, mechanical, civil, or electrical engineering experience or satisfactory combinations thereof as appropriate to the designation being sought is considered a minimum prerequisite for meeting the general qualifications of paragraph 195.a.(1) through (6). (The one year required in paragraph 195.a(6) may be included.)

c. For Designated Flight Test Pilot Representatives the following are considered minimum prerequisites for meeting the general qualifications of paragraph 195.a.(1) through (6):

(1) A currently valid commercial pilot's certificate, rated for instrument flying and the type of aircraft involved. (Instrument rating not required for helicopters.)

(2) A minimum of 2,000 solo flying hours (1,000 hours for helicopters) of which at least 100 have been logged within the past 12 months.

(3) A minimum of 100 hours of experimental flight testing experience in the type of aircraft involved.

196. SELECTION AND APPOINTMENT.

a. Request for the appointment of a Designated Engineering Representative should be initiated by the applicant or applicant's employer by FAA Form 1618, Statement of Qualification (DMIR - DER - DPRE - DME), (see Figures 5-1 and 5-2) to the Chief, Engineering and Manufacturing Branch of the pertinent regional office of the FAA, for all designations.

b. This request will indicate, when applicable, any special limitations considered appropriate with respect to authority to be delegated in each individual case.

c. This application will be referred to the appropriate office in the region which will conduct an investigation of the nominee including a personal interview. Particular care should be exercised in the selection of a designee whose authorization is to encompass the approval of changes in the type design under supplemental type certificates since he makes approvals prior to FAA review of data. Only individuals who fully meet all of the qualification requirements should be given this authorization.

d. If he is found to be satisfactory, a designation will be issued to the nominee by the Chief, Engineering and Manufacturing Branch. Such designation is represented by FAA Form 1382, Certificate of Authority and by a Certificate of Designation, FAA Form 2001. (See Figures 5-3 and 5-4.) In order to eliminate the necessity for reissuing the FAA Form 2001 whenever there is a change in the type of designation, only the title "Designated Engineering Representative" need appear on this form. The specific classifications, specialities, and limitations should be shown on the FAA Form 1382. All designees will receive a kit, which contains regulatory and technical information, and will be placed on the mailing list to receive subsequent material. The regional office will furnish or make provisions for the designee to receive any other necessary regulatory and technical information and the forms required in the performance of his delegated duties.

197. APPOINTMENT LIMITATIONS.

a. A qualified person may be appointed to act as more than one of the types of Designated Engineering Representatives listed in Part 183 of the Federal Aviation Regulations. He should be personally qualified to determine whether all the pertinent FAR coming within the scope of each of his designations are complied with.

b. A designee may be appointed for or limited to specific types of work. For example, a designation may limit the representative to handling the approval of alterations to one airplane model, to approving

under the systems and equipment engineering rating specific types of systems such as hydraulic, pressurization, etc., to approving engineering reports, drawings, and data relating to one specific engine model; or conducting flight tests on fixed wing aircraft of specified maximum gross weight. The scope of the designation and any limitation considered necessary at the time of appointment will be clearly indicated on the certificate of authority.

198. DUAL APPOINTMENTS. An individual who acts as a Designated Engineering Representative for his employer may also act as a self-employed consultant. In such cases, two separate appointments will be made and separate certificates issued unless the applicant presents in writing a statement from his employer authorizing him to use the same designation.

199. AUTHORITY AND RESPONSIBILITIES.

a. General. Engineering designees will:

(1) Ascertain that all numerical work has been checked and found satisfactory with respect to accuracy and completeness on calculations and assumptions, and for compliance with pertinent FAR, FAA policies and procedures, other approved and applicable standards, established analysis methods, and approved basic data for the model in question such as basic load data, systems diagrams, interior arrangements, operational procedures and limitations, etc.

(2) Coordinate with FAA with respect to the conduct and witnessing of static, powerplant, system operation, or flight test programs, as may be appropriate to the type of work for which they are designated and will witness all such tests, except those which the FAA wishes to witness. Designees should advise regional personnel of scheduled test dates sufficiently in advance so that regional participation can be arranged if desired. They will investigate and determine acceptability of the testing procedures utilized in such tests as they may witness for the FAA, and will forward to the FAA copies of the results of such tests. Whenever necessary as may be found during the review of tests, drawings, reports, etc., they should advise the FAA of materials, components, parts, and systems upon which special inspections and tests should be made.

(3) Be responsible for assuring that engineering reports, drawings, drawing lists, and other pertinent data which he has examined, together with his approval of/or recommendation regarding the data, are forwarded to the FAA in sufficient time to serve all necessary purposes, such as further review by the FAA prior to

issuance of a Type Inspection Authorization if tests or inspections are to be conducted by the FAA.

(4) Be responsible for certifying to the FAA that these data (reports, drawings, tests, etc.) approved by him comply with applicable FAR, with policies and procedures acceptable to the FAA, with approved specifications or allowables, and with basic load criteria or test programs previously or newly approved by the FAA.

(5) Participate as advisors in the activities of the Type Certification Board insofar as their responsibilities warrant.

(6) Consult with FAA regional personnel whenever any question arises regarding interpretation of the FAR or the use of new or unconventional materials and processes; in lieu of special interpretations, designees should be governed by procedures, allowables, standards, etc. The designees will inform the FAA regarding procedures and/or special tests or investigations considered necessary when unapproved or derived allowables, or departures from "standard" analytical procedures or detail design have been utilized in the technical data.

(7) Approve production and service changes to a model that is type certificated provided he determines that the model, when modified, continues to comply with applicable regulations, standards, etc. The extent and effect of major or significant modification shall be discussed with FAA to determine whether original design requirements (FAR, basic load criteria, test results, etc.) still apply, whether the original Application for Type Certificate will be affected, and whether additional flight testing or ground inspections are necessary.

(8) Approve manufacturer's service bulletins issued to accomplish modifications and alterations in the field, covering those aspects which fall within the field of work for which he is designated. The extent of designee approval should be shown thereon for the benefit of owners and operators, e.g., "Structural Aspects Only Approved by FAA Structural Engineering Representative." When the changes covered by the service bulletins have been requested by FAA or are to be the subject of an airworthiness directive, tne designee(s) should submit to FAA comments and recommendations on the engineering aspects of such bulletins.

(9) Be specifically authorized to examine and approve related or special data or reports such as loading schedules or devices, weight and balance reports, equipment lists, etc.

b. Operating Procedures.

(1) The following describes how the Designated Engineering Representative will function in the various phases of the engineering examination of a project required for approval. Approval of the data means that the DER has completely satisfied himself that all the pertinent FAR requirements are complied with. He may use as many experienced engineers as needed to accomplish the airworthiness evaluation of the data. He must, however, accept the responsibility for approving the technical data as complying at least with the prescribed minimum airworthiness standards. An engineering designee may decline to approve any or all portions of the technical data and may forward such data to the FAA for approval. In such instances, he should give his reasons for not desiring to approve the technical data.

(2) When a DER determines that specific data (reports, drawings, tests, etc.) investigated by him comply with all pertinent requirements and standards, he will so report to the FAA, Engineering and Manufacturing Branch, on FAA Form 8110-3. (Figure 5-5). The FAA Form 8110-3 should, in each case, outline the nature and extent of the designee's approval. The designee should take every step to assure that the FAA is advised which portions of those data or other related data he has not examined and/or approved, in order that no gaps will exist in an investigation of compliance with all pertinent requirements.

(3) FAA Form 8110-3, together with approved reports and selected drawings referred to therein, should be forwarded to the FAA Engineering and Manufacturing Branch on a continuing basis and in sufficient time to serve all necessary purposes. Whenever an item of technical data involves more than one appointed engineering designee, all designees involved should sign the FAA Form 8110-3 in order to indicate the total extent of designee approval. When the DER is submitting data and certification to engineering offices in other regions than that in which he has been appointed, he should submit a signed original and copy of the pertinent FAA Form 8110-3. When that region has made appropriate disposition of the submittal, a corresponding notation will be made on the copy, including reviewing information, project engineer's initials, and office symbol or code. The copy of the FAA Form 8110-3 will then be returned promptly to the region responsible for the supervision of the designee.

(4) The DER is responsible for assuring that he or his employer maintains a complete file of all data approved by him, in order that such data will be available for transfer to the FAA in event the employer goes out of business. The designee will be specifically advised of the extent of data to be forwarded to the FAA in conjunction with his submittal of FAA Form 8110-3.

200. REFERENCE TO APPROVED TECHNICAL DATA. Technical data submitted to the FAA by an applicant or holder of a type certificate are considered confidential and may not be released by the FAA without written permission of the owner of the data. It is therefore the responsibility of a DER to obtain such permission when reference to previously approved data is necessary.

201. APPROVAL OF ENGINEERING WORK RELATING TO TYPE CERTIFICATION.

a. Upon receipt of an Application for Type Certificate (FAA Form 312), a representative of FAA regional office will discuss necessary procedures with the applicant and the Designated Engineering Representative(s). The DER or the FAA will subsequently arrange as necessary for periodic mutual conferences to discuss problems, status of project, arrangement for reporting progress, etc., in order that the designee may be appropriately advised of particular policies, standards, and procedures which apply to the project with which he is concerned. The designee shall not make his own interpretations of a regulation when more than one interpretation is possible.

b. Structural, powerplant, engine, propeller, and systems and equipment technical data (other than basic load criteria for new models, new allowable loads and new analytical methods) may be examined by the DER to determine compliance with pertinent requirements. He will be responsible for approval of such data as he is authorized to investigate under the terms of his designation, insofar as he is requested to do so by his employer, and insofar as he is willing to accept such responsibilities.

c. Static, powerplant, flight, and other test programs should be coordinated with the pertinent FAA office in accordance with paragraph 199.a(2). Programming, conduct, and arrangements for witnessing of tests will be accomplished on a continuing basis by the DER. The designee will be specifically informed of those tests which FAA may wish to witness and approve.

202. SUPPLEMENTAL TYPE CERTIFICATION.

a. An engineering representative may, within the limits of this authority approve data covering major changes in the type design not great enough to require a new type certificate (FAR 21.113) and obtain supplemental type certificates without prior review by FAA. Postreview will be made for FAA Engineering; therefore. the FAA Form 8110-3 and data covering such approvals should be sent to the FAA regional Engineering and Manufacturing Branch immediately.

b. If FAA flight tests are considered to be necessary, the completed FAA Form 8110-3 should be forwarded to the FAA Engineering and Manufacturing Branch with a request for issuance of a TIA. In such instances, the technical data involved cannot be considered as

"approved" until such FAA inspections have been satisfactorily completed. A TIA will also be issued when flight tests are to be conducted by a Flight Test Pilot Representative. The DER who approves the data should work out the flight test program with the Pilot and Flight Analyst Representatives and the complete file should be submitted with FAA Form 8110.3.

c. A DER may also be authorized to conduct compliance inspections.

203. TRAINING AND SUPERVISION.

* a. The appropriate branch chief in the FAA regional office is responsible for indoctrination of each designee appointed by that office. In this connection and keeping in mind the basic required qualifications for designee appointment (particularly paragraph 195.a(2)), the designee will be familiarized with all necessary administrative procedures, practices, and official records and will be provided with all pertinent forms and instructions. The designee will be contacted as necessary to assure that he is currently and adequately informed with respect to changes in policies, procedures, practices, regulations, and associated standards, and that he is accomplishing his designee activities in an acceptable manner. *

b. In general, the designee will be guided by the same requirements, instructions, and procedures applicable to FAA employees in the performance of similar duties.

* c. DER submittals are to be retained in FAA files until disposal is called for in accordance with applicable guidelines. DER submittals may be reviewed or postreviewed by FAA. When the data have been accepted, the responsible project engineer will initial and date the FAA form 8110.3, and indicate which, if any, data have been reviewed. The proportion of each DER's approved data to be reviewed by FAA and the depth of that review should be proportional to the experience of FAA with the individual DER. During the first year of a DER's appointment, approximately one third to one half of the DER's submittals should be reviewed or postreviewed sufficiently to assure compliance with applicable regulations. After one year of satisfactory experience with no major airworthiness deficiencies noted, the review level may be reduced; but approximately 5 percent of every DER's submittals should be reviewed or postreviewed by FAA.

d. In every case, when a major airworthiness deficiency is noted (one which would seriously affect the airworthiness of the product), the previous submittals by the DER should be postreviewed 100 percent going back chronologically far enough to reasonably assure that the DER's previous submittals were satisfactory. In addition, submittals by that DER in the future should be reviewed at least at the 50 percent level until there is reasonable assurance that the DER performance is satisfactory. *

204. DURATION AND RENEWAL OF DESIGNATIONS.

a. Engineering representative designations expire 12 calendar months

after the last day of the month during which they are issued or last renewed. They may be renewed at any time within 90 days prior to the expiration date provided that concurrence of all concerned is evident. Although the expiration of designation differs from a termination (in that the latter is usually for cause), a designation which has expired is not renewable without review. In such instances, the original designation number may be reassigned to the same individual, but reissuance of the expired designation will be handled in the same manner as the original appointment.

* b. A new FAA Form 8430-9 must be issued each time a designation is renewed in order to specify the new expiration date. The original number will be retained. *

c. The designation number to be used is the regional office prefix followed by a dash and the consecutive number of designees in that region.

* d. The FAA Form 8000-5 need not be reissued; however, upon expiration or cancellation of a designation, the FAA Form 8000-5 should be returned to the FAA. If a designee wishes to retain the FAA Form 8000-5, then he may do so * provided it is first returned to the FAA and is marked CANCELED or EXPIRED.

e. Since a designee is identified by number to the FAA authorizing office, a geographical transfer of a designee and/or his employer from one FAA *region to another necessitates the return by the designee of the FAA Form 8430-9, Certificate of Authority, and FAA Form 8000-5, Certificate of Designation, to the original authorizing region. That region will then notify the new region in which the employer and designee will be located. The new region will then reissue the FAA Forms 8430-9 and 8000-5 under a new number in accordance with * its regional numerical sequence. There is no geographical limitation on the area in which a designee may work.

205. GUIDANCE MATERIAL KITS.

* a. A Guidance Material Kit for each designee can be obtained following his selection and appointment by submitting his name and mailing address to the Program Management Staff, AFS-103. When a new DER is appointed, an existing DER has a change of address, or a designation expires/is canceled, the Engineering and Manufacturing Branch/Aircraft Engineering Division should submit required information on two copies of FAA Form 1770-7.

(1) If the DER is self-employed, "FDR-2" should be on line 1; his name (two initials and last name only) and designation number should be on line 2; and his address should be on lines 4 and 5.

(2) If the DER is employed by a manufacturer, "FDR-2" should be on line 1; the employer's name should be on line 2; his name (two initials and last name only) and designation number should be on line 3; and the employer's address should be on lines 4 and 5.

b. FAA Form 1770-7, DMIR/DER Mailing List Action Request, is stocked in *

*the FAA depot and may be obtained by referring to NSN:0052-00-851-8000, unit of issue: sheet.

c. The following publications will be included in each Guidance Material Kit shipped from the DOT warehouse:

(1) Federal Aviation Regulations Parts 1 thru 49, 91, 121, 133, and 183.

(2) Advisory Circulars, Aircraft, Subject No. 20.

(3) Summary of Supplemental Type Certificate Supplements.

(4) Order series 8110 and 8150 (except 8110.6).

d. The appropriate branch chief in the FAA regional office is responsible for assuring that a Guidance Material Kit is provided to each designee appointed. All necessary forms, instructions, and other material not in the Kit described above are still to be provided by that office as outlined in paragraph 203a. A designee's request for additional material or material that was not included in the original Kit submitted should be sent to the designating FAA regional office. *

206. -208. RESERVED.

* CHAPTER 6. AIRWORTHINESS CRITERIA - CATEGORY II AIRBORNE SYSTEM EVALUATION

209 GENERAL - CATEGORY II APPLICABILITY. Engineering and Manufacturing personnel are responsible for data review, conformity inspections, and flight tests as necessary to determine airworthiness compliance of Category II equipment and systems installations. Flight operations specialists will participate as indicated in Section 166 of this handbook.

210. EQUIPMENT AND SYSTEMS INSTALLATION APPROVAL - CATEGORY II

a. Data submitted, whether approval basis is a technical standard order or equivalent, or a part of the type design, should be reviewed to assure that the design concepts and principles, including provisions for reliability, failure warning and monitoring, are in compliance with applicable regulations.

b. Failure analysis should be reviewed to determine that a hazard to the operation of the airplane is not created following a failure of the equipment or system at any point in the approach. Displayed information should be sufficient for correct decision-making following such a failure.

c. Applicable criteria should be considered as presented in Advisory Circulars 91-16, 120-20, 23.1329-1, and 25.1329-1.

211. ELECTRICAL AND ELECTRONIC SYSTEMS - CATEGORY II

a. In addition to consideration of items included in Section 97 of this handbook, electrical/electronic systems installed in airplanes certificated to the requirements of CAR 4b or FAR 25 should be investigated for reliability and provisions for fail-safe functional continuity.

b. Monitoring systems, flag circuits and displays should be examined for purpose and effectiveness in their intended function in simulated malfunctions, such as pulling circuit breakers, to verify that they perform properly.

212. INSTRUMENTS - CATEGORY II

a. In addition to consideration included in Section 104 of this handbook, instruments should be evaluated for accuracy and reliability of performance in manual approaches OR in monitoring coupled automatic pilot approaches OR both. The TIR should reflect the extent of evaluation conducted, which should include a deviation profile. *

* b. When the radio altimeter is in the upper right position in the "basic tee," the barometric altimeter should be positioned to the right and adjacent to the radio altimeter. When the barometric altimeter is in the "basic tee," the radio altimeter should be adjacent to the barometric altimeter and may be either to the right of, below or diagonally to the right. Other radio altimeter locations proposed by applicants should be coordinated in detail with FS-100/ FS-400 prior to installation approval.

213. AUTOMATIC PILOTS AND COUPLERS - CATEGORY II

a. If approval is sought for automatic coupled approaches only, the associated flight director system, if installed, need not meet the performance requirements of pertinent guidance (advisory circular) material.

b. An applicant whose autopilot installation is previously approved need only conduct those tests associated with the requirements of Category II.

c. When force wheel steering, in conjunction with a flight director approach is being evaluated, the criteria applicable to flight director (manual) approaches should be used. When force wheel steering is operative during an automatic coupled approach, the criteria applicable to automatic pilot/coupler approaches should be used.

214. FLIGHT EVALUATION - CATEGORY II

a. Following engineering design and ground testing program evaluation, a Type Inspection Authorization (TIA) should be prepared. Flight operations specialists will participate in the program as indicated in Section 166 of this handbook.

b. Flight test program should include determination of freedom from interferences between systems, performance of each system with respect to tolerances established for Category II operation, covering representative and critical phases of operation including equipment malfunction simulation.

c. System performance should be determined with the airplane on a stabilized approach following (1) the glide slope intercept, and (2) transition to the landing configuration. If the applicant elects to use a flap setting less than landing flap, suitable landing performance information should be provided.

d. The demonstration of an engine out missed approach from a particular configuration or altitude, following the simulated loss of an engine, is not a requirement peculiar to Category II airborne systems approval. Such demonstrations are considered a part of the basic aircraft evaluation. *

* e. Determination of altitude loss associated with automatic pilot malfunction and radio altimeter accuracy should be accomplished in accordance with the applicable advisory circular, unless previously accomplished as part of separate system approvals.

f. A sufficient number of approaches within Category II tolerances should be conducted on a commissioned ILS ground facility.

g. Recordings should be made and retained as type design data of localizer and glide slope channels and radio altimeter readings for both automatic and manual approaches.

h. Upon satisfactory completion of the engineering inspection and test program, the airplane flight manual or supplement thereto, or markings or placards should reflect the following:

(1) Limitations, if any.

(2) Revisions to the performance section, if appropriate.

(3) A statement to the effect that "the airborne instruments and equipment meet Category II performance standards."

NOTE: Compliance with the performance standards referenced above, does not constitute approval to conduct Category II operations. *

215.-218. Reserved.

* CHAPTER 7. DESIGNATED ALTERATION STATION AUTHORIZATION

219. AUTHORIZATION. The authorization to operate as a Designated Alteration Station (DAS) will be the issuance of an Air Agency Certificate, FAA Form 8000-4. This form may be obtained from the FAA Depot (Aeronautical Center) by referring to FSN: 0052-027-1001. This certificate shall note the limitations of the authorization. (See Appendix 3, Page 7, for an example of a completed certificate.) The envelope of limitations may be of any form. It may be limited for lack of certain equipment or, as an example, limited to FAR 23 and CAR 4a airplanes.

220. PROCEDURE MANUAL. Care should be exercised in the review and approval of the DAS procedural manual required by FAR 21.441 to ensure the DAS has a clear understanding of the procedure for obtaining compliance with the regulations.

221. ISSUANCE OF SUPPLEMENTAL TYPE CERTIFICATES.

a. After approval of the procedure manual, the region will issue to the DAS a block of 25 numbers which will be used to identify Supplemental Type Certificates issued by the DAS. The numbers issued will be in accordance with paragraph 46d, except that each number to be issued by a DAS will have a "-D" placed after the regional symbol. For example, SA25WE-D would be an STC issued by a DAS in the Western Region.

b. The regions will provide indoctrination training in preparation for the issuance of a supplemental type certificate.

222. INSPECTION AND SURVEILLANCE.

a. Success of the program to delegate authority to Designated Alteration Stations will depend largely on the educational and surveillance program established by the regions to assist in securing compliance with the FARs.

b. The degree of frequency of regional monitoring of a DAS should be based on a review of DAS approvals and service difficulties.

223.-225. RESERVED. *

FIGURE 2-1. SAMPLE TYPE CERTIFICATION PROJECTS STATUS, FAA FORM 8110-13

TYPE CERTIFICATION PROJECTS STATUS

RIS: FS 8110-3

REGION: SOUTHERN | PAGE: 1

TYPE REPORT: [X] QUARTERLY [ ] SUPPLEMENTAL

PERIOD: March 31, 1970

PROJECT NUMBER	MAKE AND MODEL AND DATE OF APPLICATION	DESCRIPTION	NEW TC	AMEND TC	STC	OTHER	ESTIMATED TOTAL MAN-HOURS	% COMPLETE AND ESTIMATED DATE OF COMPLETION	DATE OF APPROVAL
CA330SO-D	Burns BA-42 Orig. 6/12/64 New 5/23/67	Burns Aircraft Corp., Starkville, Miss. - Six place conventional light twin aircraft, all metal, low wing, approx. G.W. 4800 lbs.	X				10900	88% 6/30/70	
T913SO-D	Lockheed 1329 8/11/67	Lockheed-Georgia Company, Marietta, Georgia - Install. of warning tone generator (JR-755)		X			250	92% 6/30/70	
CA1222SO-DO	Piper PA28R-260 10/8/69	Piper Aircraft Corporation, Vero Beach, Florida - Install of 260 h.p. Continental Hydra Torque engine, Model CMC6-260. G.W. 3100 lbs. substantiated in normal category	X				450		Cancelled 3/10/70
T1242SO	Grumman G-1159 12/10/69	Grumman Aerospace Corporation, Savannah, Georgia - Adding of "off" position to utility hydraulic switch		X			64	8% 5/30/70	
CA427SO	Falcon F-1 9/2/69	Falcon Aircraft Corporation, Knoxville, Tennessee - 3-place land bi-plane in normal category	X				1850	2% 6/30/71	

FAA Form 8110-13 (3-70) SUPERSEDES LOCAL FORMS

FIGURE 2-2. TYPE PROJECT IDENTIFICATION CODE

Symbol Position 1 2 3 4 5 6 7 8	Symbol Identification Description
C	Complete type certification project (A new type certificate to be issued or new model to be added to old type certificate)
A	Aircraft (12,500 lbs. or less)
G	Glider
H	Helicopter
L	Lighter-than-air
T	Transport aircraft (all aircraft over 12,500 lbs.)
E	Reciprocating piston engine powerplant
J	Jet and turbine powerplants
R	Rocket
P	Propeller
Z	Miscellaneous
1	Number of project
EA. . . .	Symbol of region
- . . .	Separating symbol
D . .	Designated Engineering Representative actively engaged on the project
D O .	Delegation option project
M .	Military project (contractural requirements usually specify project must be eligible for type certification)
* S	Supplemental type certificate
T	TSO Compliance *

Example: Project CA3EA-D would be a complete type project; an aircraft is involved; it is the third type project (either complete or partial) established in the region; it is being handled by personnel in the Eastern Region; and a designee is actively engaged.

* Project Z834EA-T would be a TSO compliance project. The symbol T is only used in connection with the symbol Z. *

FIGURE 3-1. ATTACHMENT TO PROPELLER TYPE INSPECTION AUTHORIZATION

TIA CP-9990-EADO

Date February 29, 1977

Make WHIRLY Model WH3-2425RZ/8999

The applicant proposed to comply with pertinent test requirements of FAR 35 as indicated in Section I below. Items so indicated have been waived on the basis of substantiating data submitted to the Regional Propulsion Section. Specified tests may be conducted in any sequence that the applicant chooses.

The teardown inspection program outlined in Section II below is to follow completion of all tests, and is not necessarily limited to the inspections itemized.

Witness as many of the following tests and inspections as considered necessary to validate the applicant's test reports.

Items IB(3) and IIC(1) to be witnessed by FAA personnel from EA-214.
Items II.A., II.B., II.C.(1) and II.D. to be witnessed by FAA personnel from EA - EMDO-45.
Items I.A.(1) or I.A.(2), I.B.(1)(2)(3), I.C.(1) to be witnessed by FAA designee E. Z. BAKER, WHIRLY CO.

SUGGESTED FORMAT

I. Type Test Schedule

A. Centrifugal Load Test. For hub and blade retention system.

(1) One hour whirl of propeller at 3100 p.r.p.m.

OR

(2) Static pull of dummy blades in hub at 100,000 lbs.

(3) One hour whirl of hub with dummy blades at 3,100 p.r.p.m.

B. Endurance Test.

(1) 70 hours at 240 hp. and 2200 p.r.p.m. (Proposed engine REZIP CORP. Model GO-330 geared .666 engine r.p.m. 3300.)

(2) 30 hours at 185 hp. and 1800 p.r.p.m. . (Engine same as for (1)).

(3) 10 hours at 250 hp. and 2400 p.r.p.m. (Proposed engine REZIP CORP. Model GO-330A geared .666 engine r.p.m. 3600).

(4) Endurance test during engine test as covered by TIA No. CP-9999 EA dated April 13, 1977 for the REZIP CORP. Engine Model GO-330A.

C. Functional Test.

(1) 1500 complete cycles of pitch change by means of the automatic control mechanism.

(2) 50 complete feathering cycles. With operation of feathering control, mixture control may be moved to idle cutoff, or throttle may be closed, or the engine stopped.

(3) 200 complete reversing cycles. During each cycle, propeller will be operated in full reverse pitch for one minute.

D. Special Tests.

SUGGESTED FORMAT

II. Teardown Inspection Program.

A. Inspection of all parts for wear and corrosion. Determine extent of wear.

B. Conformity checks.

C. Inspection for defects and failures of the parts listed below by the magnetic particle, dye penetrant, fluorescent penetrant, acid etching, or anodizing process where applicable, supplementing one process by another where necessary. If unclear indications of defects or failures are found, supplement these inspections by X-ray inspection.

(1) Blades, hub bodies and spinners, blade retention parts, parts that transmit motion when changing pitch, pitch stops, areas in spinners in vicinity of mounting bolts.

(2) For hollow blades that cannot be inspected internally, supplement the normal inspections by X-ray inspection.

D. If assigned inspector considers any other inspections necessary, please contact the regional Propulsion Section.

III. General Information

A. Location of tests:

Whirly Co., Pitching Ford, Mass.

Rezip Corp., Camsville, New York.

FIGURE 5-1. STATEMENT OF QUALIFICATIONS, FAA FORM 1618 (DMIR - DER - DPRE - DME)

SAMPLE

FEDERAL AVIATION AGENCY

STATEMENT OF QUALIFICATIONS
(DMIR – DER – DPRE – DME)

Form Approved: Budget Bureau No. 04-R090.2

INSTRUCTIONS: Print or type all entries except Signatures.

1. NAME (Last, first, middle): DOE, John D.

3. U.S. CITIZEN: X YES ___ NO

2. ADDRESS (Number, street, city, state, and ZIP code): 352 N. Bangor Ct., Irving, Texas 75060

4. DATE OF BIRTH: June 9, 1933

5. DESIGNATION SOUGHT

	DESIGNATED MANUFACTURING INSPECTION REPRESENTATIVE (DMIR)					
	DESIGNATED MECHANIC EXAMINER (DME)	AIRFRAME RATING			POWERPLANT RATING	
	DESIGNATED PARACHUTE RIGGER EXAMINER (DPRE)	SEAT		BACK	CHEST	OTHER
X	DESIGNATED ENGINEERING REPRESENTATIVE (DER): (Consultant)	X STRUCTURAL ENGINEERING, FAR 23&25		ENGINE ENGINEERING		
		POWERPLANT ENGINEERING		PROPELLER ENGINEERING		
		SYSTEMS AND EQUIPMENT ENGINEERING		FLIGHT ANALYST		
		RADIO ENGINEERING		FLIGHT TEST PILOT		

6. EXPERIENCE RESUME FOR PAST 5 YEARS PERTINENT TO DESIGNATION SOUGHT (Use additional sheets if necessary)

DATES FROM	DATES TO	EMPLOYER'S NAME	POSITION TITLE AND DUTIES
7-66	Pres.	J. D. Doe & Associates, Consultant Aeronautical Engineers, Dallas, Texas	President and Chief Engineer
9-56	7-66	ACB Aircraft Co. Wichita, Kansas	Chief Structures Engineer. Responsible for structural substantiation of all models.

7. EDUCATION AND TRAINING HIGH SCHOOL LEVEL AND ABOVE PERTINENT TO DESIGNATION SOUGHT

DATES FROM	DATES TO	NAME OF SCHOOL	CURRICULUM OR STUDY PROGRAM	DEGREES RECEIVED
9-51	9-56	University of Wichita Wichita, Kansas	Aeronautical Engineering	B. S.

8. FAA CERTIFICATES NOW HELD PERTINENT TO DESIGNATION SOUGHT

TYPE	CERTIFICATE NO.	RATING	DATE EACH RATING ISSUED
Private Pilot	1626574	Airplane Single Engine Land	3-08-65

9. EMPLOYER'S RECOMMENDATION (To be completed for DER and DMIR only)

I RECOMMEND THE PERSON IDENTIFIED ABOVE BE APPOINTED AS:
___ DESIGNATED ENGINEERING REPRESENTATIVE ___ DESIGNATED MANUFACTURING INSPECTION REPRESENTATIVE

DATE	PRIMARY BUSINESS	SIGNATURE
(NOT APPLICABLE	- SELF EMPLOYED CONSULTANT)	

10. LOCATION WHERE DESIGNEE FUNCTIONS WILL BE PERFORMED (To be completed for DME and DPRE only)

ADDRESS	TELEPHONE NO
(NOT APPLICABLE)	

11. CERTIFICATION: I certify that the above statements are true to the best of my knowledge and that I am familiar with the Federal Aviation Regulations pertinent to the designation sought.

DATE	SIGNATURE
July 1, 1967	John D. Doe

FAA Form 1618 (6-65) OBSOLETE PREVIOUS EDITION AND REPLACES FAA FORM 1381 AND FAA 1599 WHICH ARE OBSOLETE. 0052-047-2000 (3300-8310-8100)

FIGURE 5-2. REVERSE OF FAA FORM 1618

ACTION RECORD *(For FAA Use Only)*

I. RECORD OF APPROVAL *(For original or redesignation)*

1. DESIGNATION – RATINGS/CLASSIFICATIONS					2. DESIGNEE'S NAME
	DESIGNATED MANUFACTURING INSPECTION REPRESENTATIVE				
	DESIGNATED MECHANIC EXAMINER		AIRFRAME		JOHN D. DOE
			POWERPLANT		3. DESIGNATION NUMBER
	DESIGNATED PARACHUTE RIGGER EXAMINER		SEAT	CHEST	SW-241
			BACK	OTHER	4. EFFECTIVE DATE
X	DESIGNATED ENGINEERING REPRESENTATIVE (Consultant)	X	STRUCTURAL ENGINEERING		July 1, 1966
			POWERPLANT ENGINEERING		5. DATE CERTIFICATE OF AUTHORITY EXPIRES
			SYSTEMS AND EQUIPMENT ENGINEERING		July 1, 1967
			RADIO ENGINEERING		6. DATE STATUS REPORT FOR DESIGNEE FORWARDED
			ENGINE ENGINEERING		(NOT APPLICABLE)
			PROPELLER ENGINEERING		7. INSPECTOR'S SIGNATURE
			FLIGHT ANALYST		
			FLIGHT TEST PILOT		(NOT APPLICABLE)

II. RECORD OF SUBSEQUENT ACTIONS

TYPE			NEW ADDRESS AND TELEPHONE NO. *(If changed)*	DATE STATUS REPORT FOR DESIGNEE FORWARDED	FAA OFFICIAL
ANNUAL RENEWAL	CHANGE OF ADDRESS	CANCELLATION			
---	12-66	---	1805 N. Water Street Fort Worth, Texas	-----	Charles B. Lee
7-67	---	---	Same as above	-----	Tom A. White

FIGURE 5-3. CERTIFICATE OF AUTHORITY
FAA FORM 8430-9

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
CERTIFICATE OF AUTHORITY

DESIGNATION NO
SW-241

NAME
John C. Doe

DESIGNATION EXPIRES
7-1-70

DESIGNEE'S SIGNATURE
John C. Doe

Is authorized to act in the capacity of a
(Consultant)
Designated Engineering Representative
~~AT AREA BASE OR ORGANIZATION~~
Structures, FAR 23 and FAR 25

for the Administrator

7-1-69
(DATE)

Paul R. Brown
(SIGNATURE)
Chief, Engr. & Mfg.Branch

FAA FORM 8430-9 (1-70) FORMERLY FAA FORM 1382

(Obverse of FAA Form 8430-9)

The bearer has received all pertinent instructions and is authorized to act in the capacity set forth on this Certificate of Authority while under the supervision of the following district office or offices:

Office	Date	Inspector's signature
(NOT APPLICABLE)		

GPO 1970 O - 394-923

(Reverse of FAA Form 8430-9)

The United States of America

Federal Aviation Agency

Certificate of Designation

Reposing special trust and confidence in the integrity, diligence, and discretion of

JOHN C. DOE

and finding that he has the necessary knowledge, skill, experience, interest, and impartial judgment to merit special public responsibility, I have designated him

DESIGNATED ENGINEERING REPRESENTATIVE

and authorize him to act in accordance with the regulations and procedures prescribed by the Federal Aviation Agency relating to this designation.

Issued at SOUTHWEST REGION, FORT WORTH, TEXAS

Dated JUNE 29, 1964

Certificate No. SW-241

By Direction of the Administrator

Paul R. Brown

Paul R. Brown

Chief, Engineering and Manuf. Branch

FORM FAA 2001 (7-60)

FIGURE 5-4. CERTIFICATE OF DESIGNATION FAA FORM 2001

* FIGURE 5-5. STATEMENT OF COMPLIANCE OF AIRCRAFT OR AIRCRAFT COMPONENTS WITH THE FEDERAL AVIATION REGULATIONS - FAA FORM 8110-3

DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION **STATEMENT OF COMPLIANCE OF AIRCRAFT OR AIRCRAFT COMPONENTS WITH THE FEDERAL AVIATION REGULATIONS**	DATE August 21, 1969

CLASSIFICATION OF DESIGNEE
Structures

MODEL NO.	MODEL TYPE (*Airplane, Radio, Helicopter, etc.*)	NAME OF EMPLOYER
460	Airplane	Self-Employed Consultant FOR: ABC Aircraft Corporation

LIST OF APPROVED REPORTS AND DATA

NUMBER	TITLE
ENGINEERING REPORTS	
50-173-1	Wing Structural Analysis
50-173-2	Wing Static Test Results
DRAWING	
1735402	Wing Structural Assembly

CERTIFICATION: Under the authority vested in me by the Federal Aviation Administration, I hereby certify that the data listed above and on attached sheets numbered (None) have been examined in accordance with established procedures and found to comply, to the best of my knowledge and belief, with the pertinent requirements of the Federal Aviation Regulations.

I therefore ☐ recommend approval of these data.
☒ approve these data.

DESIGNATION NUMBER	SIGNATURE(S) OF DESIGNATED ENGINEERING REPRESENTATIVES
SW-241	John Doe

FAA Form 8110-3 (12-68)

SAMPLE

* FIGURE 5-8. DELEGATION OPTION AUDIT COMMENT ITEM

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Western Region

DELEGATION OPTION AUDIT BOARD COMMENTS

Manufacturer_____ Team No._____ Date_____

FAR Involved_____

Condition_____

Supporting Documents_____

Signatures_____
Team member collecting evidence Team leader

Board Decision: Noncompliance ☐

Recommendation ☐

No action required ☐

Signature _____
Chairman, DO Board

*

FIGURE 5-9. AIR AGENCY CERTIFICATE - FAA FORM 8000-4

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

Air Agency Certificate

Number DAS1EA

This certificate is issued to
ABC AIRLINES

whose business address is
TULSA, OKLAHOMA

upon finding that its organization complies in all respects with the requirements of the Federal Aviation Regulations relating to the establishment of an Air Agency, and is empowered to operate an approved DESIGNATED ALTERATION STATION

with the following ratings:

As set forth in ABC Airlines FAA Approved
Designated Alteration Station Procedure Manual.

This certificate, unless canceled, suspended, or revoked, shall continue in effect

By direction of the Administrator

Date issued:

June 26, 1967

John Smith
Director, Eastern Region

This Certificate is not Transferable, AND ANY MAJOR CHANGE IN THE BASIC FACILITIES, OR IN THE LOCATION THEREOF, SHALL BE IMMEDIATELY REPORTED TO THE APPROPRIATE REGIONAL OFFICE OF THE FEDERAL AVIATION ADMINISTRATION

Any alteration of this certificate is punishable by a fine of not exceeding $1,000, or imprisonment not exceeding 3 years, or both

FAA Form 8000-4 (1-67) SUPERSEDES FAA FORM 390. ☆U.S. GOVERNMENT PRINTING OFFICE: 1977— 240-897.55

CHANGE

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

8110.4 CHG 23

2/2/84

SUBJ: TYPE CERTIFICATION

1. PURPOSE. This change introduces a new FAA Form 8110-26 (RIS: WS 8110-16), Supplemental Type Inspection Report (STIR), which provides a means to record results of inspections accomplished during supplemental type certification programs.

2. FORM AVAILABILITY. An initial supply of FAA Form 8110-26 (RIS: WS 8110-16) STIR will be distributed to all concerned offices, and will be available from the FAA Depot through normal distribution channels. The national stock number is 0052-00-887-9000, and the unit of issue is set.

3. DISPOSITION OF TRANSMITTAL. This change transmittal may be retained.

PAGE CONTROL CHART

Remove Pages	Dated	Insert Pages	Dated
49	12/28/67	49	12/28/67
50	12/28/67	50	2/2/84

J. A. Pontecorvo
Acting Director of Airworthiness

Distribution: A-W(WS)-3; A-X(FS)-2; A-X(CD)-4; A-Y(VN)-3; A-FFS-1, 2,5,7,8(LTD); A-FIA-0(LTD); A-FAC-0(MAX); FDR-2

Initiated By: AWS-200

*U.S. GOVERNMENT PRINTING OFFICE:1989-717-000:03939